IN THIS ISSUE—HOW MOTOR TRUCKS SAVED VERDUN

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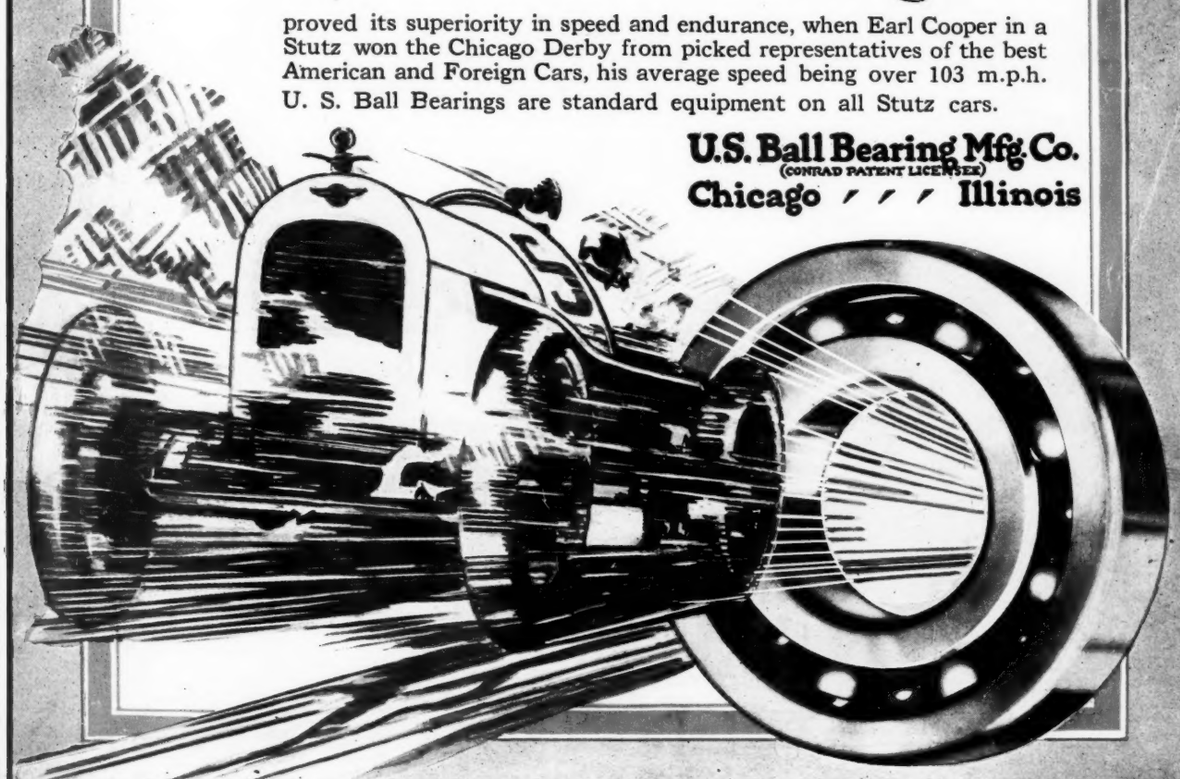

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May 10 1917

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The Automobile and Automotive Industries

VOL. XXXVII NEW YORK—THURSDAY, JULY 19, 1917—CHICAGO No. 3

France Saved by Trucks

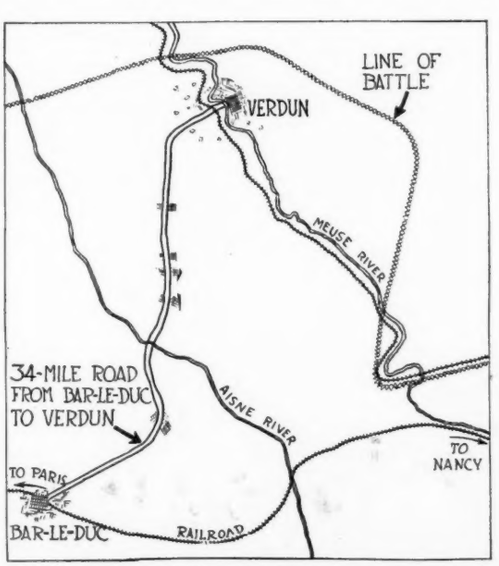
Verdun, Key to Paris, Would Be in German Hands To-day But for Yeoman Work of French Automobile Service in Maintaining Army's Line of Communication

¶EDITOR'S NOTE.—The following article by W. F. Bradley, special representative of THE AUTOMOBILE AND AUTOMOTIVE INDUSTRIES *with the allied armies, is the first accurate and detailed account of the inestimable services performed by automobiles and motor trucks in the siege of Verdun. This article has been officially approved by the head of the Automobile Service of the French Army*

By W. F. Bradley

VERDUN would have been in German hands to-day but for automobiles and motor trucks. This is an established fact to all students of military events and to those familiar with the work of the automobile service during the last 2 or 3 years. One authority maintains that the Germans were defeated on the Marne owing to the breakdown of their transport, first their railroads being unequal to the task and, second, the road transport failing under the extra strain imposed on it. Whether this is so or not cannot be fully proved, for the facts are held by the enemy only.

But what happened at Verdun in the early days of 1916 is not now a secret. When the Crown Prince began to put in his rapid, sledge-hammer blows in February, 1916, his first thought was to harass and, if possible, cut off French supplies from the rear to the ring of forts north of Verdun. Even a slight acquaintance with the war map of Europe shows that no better point could have been selected for a German attack. Just to the east of Verdun the enemy lines formed—and still form—a deep V into French territory, so that while the German lines were just a few miles to the north of the city, the most advanced German point was 20 miles to the rear of the city, in a southeasterly direction. This enabled the enemy to shell the lines of communication a very long way to the rear of the Verdun front and it also constituted a menace of a huge enveloping movement, with the German armies sweeping right into the Champagne plains. As fort after fort fell in that long-drawn-out battle of early 1916, and the German army moved nearer and nearer to Verdun until the possibility of the fall of the city began to be hinted at, not a person in France failed to realize the portentous nature of the struggle. A breach at this point and the open road to Paris might again have faced the Kaiser's troops.



Line of communication of French Army maintained by motor vehicles in siege of Verdun

At the outset of this gigantic struggle, the French staff found itself deprived to a very great extent of the use of railroads. Thirty-four miles south of Ver-

dun is the town of Bar-le-Duc, served by the main railroad line from Paris to Nancy, and with good means of communication with all the interior of France. But although directly in the rear of Verdun, the point of that German V projecting into France brought Bar-le-Duc to within 20 miles of the enemy, and made it the most advanced railroad depot which could be used to any great extent for supporting the troops operating just to the north of Verdun. Speaking generally, there was a zone 34 miles deep in which no railroad could operate, and that particular zone was the center of the most desperate and prodigal attacks ever known in the history of the world.

Motor Vehicles the Only Salvation

If Verdun was to be saved, it could only be accomplished by the use of automobiles and motor trucks on a scale hitherto undreamed of in warfare, and by a service which would more than compensate for the loss of the railroad. The nature of the front made it impossible for there to be any converging lines, for, starting from Bar-le-Duc, the roads to Verdun ran for more than half their distance parallel to the German lines, and were consequently under German fire. To make matters worse, this particular portion of France was less liberally supplied with roads than the average, so that when the automobile service was informed that it would have to be relied on almost exclusively to take up the thousands of tons of ammunition required for the Verdun forts, to transport reserve troops, to keep the army supplied with food and other supplies, to evacuate the wounded, the officers of that service had to face the fact that they had only one good road available, and it was classed as a "Chemin de Grande Communication," or third-class road, not wide enough for three vehicles abreast.

To obtain the maximum efficiency from this road it was closed to all but automobile traffic. No horse vehicle, no cavalry, no troops afoot were allowed to travel on that all-important 34-mile stretch of road from Bar-le-Duc to Verdun. The lack of an alternative route made it impossible to establish one-way traffic. The road was divided into six sections, each one in charge of a responsible traffic officer, assisted by an adjutant, having at their disposal three touring cars, two light cars, three motorcycles, together with their drivers, and also nine non-commissioned officers and automobile drivers, and a number of gendarmes, or military police.

Traffic Regulations Strict

The general instructions were brief and vigorous. All automobile traffic had to travel in sections of five vehicles, the last one of each section carrying at the rear a big red disk emerging above the top of the body. While the regulation distance between trucks was 10 to 15 yd., and on no account were sections to be broken up, it was forbidden to approach within 50 yd. of a red disk. If, for any reason whatsoever, it became necessary for the traffic police to hold up the vehicles, they only did so between two sections.

No obstruction of this 34-mile stream of traffic was tolerated. If a vehicle stopped it had to get off the road at once. The traffic police were responsible for the carrying out of this rule, and as they were all practical automobile drivers, they were able to decide whether circumstances justified the crew of the truck occupying a few yards of the roadway for the necessary repair, or whether the vehicle should be run into the ditch without loss of time. Discretion, of course, had to be observed, and as the volume of traffic varied at different hours of the day and night, it was sometimes possible to allow the driver to carry out a repair, while at other times the truck had to be levered right off the road even if 5 minutes would have been sufficient to get it under way again. Field telephones worked along the whole length of the road, and on a truck breaking down the message was carried back to the depot at which it was attached, and help would be sent out. The break-down gangs were subjected to the same general rules against obstruction. Thus, when they decided to tow a truck home they had to select by-ways, dirt roads, or cross-country tracks, instead of the main highway.

No Obstruction Permitted

In some cases broken-down trucks had to be got off the road with no other consideration than the saving of time, in consequence of which they were pushed or levered into the ditch and turned over completely or partly. At intervals of a few days, and when the military situation admitted, the road was closed to all traffic for 2 or 3 hr. and the break-down gangs sent out with all necessary tackle to bring in the wrecks. In these cases they could occupy a portion of the road and erect whatever tackle was required to lift a heavy vehicle out of the ditch onto the road.

With trucks divided into sections of five, no stoppages provided for, and a uniform speed of 9½ m.p.h., there was never any necessity for one truck to overtake another. This road was used, however, not only by trucks but by officers' touring cars, ambulances and telegraphic cars, which generally operated singly. It was for the benefit of these, the speed of which had not to exceed 20 m.p.h., that the section system of five trucks and 50-yd. gaps was adopted. It was up to the drivers of these cars to rush a section of five trucks, and thus gain a place, whenever an opportunity presented itself. The road was not wide enough for two trucks and a touring car to run abreast, thus no touring car or ambulance driver had to attempt to move up a section unless he saw that he could pass the five trucks before meeting an oncoming section. Under maximum traffic conditions overtaking was not possible, for as each section would occupy a minimum of 80 yd., with only 50 yd. interval between them, the sections in the two streams would always overlap. It was only occasionally, however, that the line was absolutely unbroken, and the driver who moved to the left in order to get ahead of the slower traffic knew that at regular intervals of 80 yd. he would find a safety gap if a stream of traffic was observed to be approaching.

Army Corps Moved in 10 Hours

This system was a marvel of organization, which will always be to the credit of the automobile service of the French army. At times there were —— trucks on that main road, the Sacred Way, they called it, to Verdun. There passed through the once sleepy town of Bar-le-Duc an average of —— trucks per day. In this district could be seen the remarkable sight of —— White trucks on the road together, every twenty-fifth truck being a kitchen and every fiftieth a workshop. On one occasion during the struggle an entire army corps of —— men was moved up to Verdun within a period of 10 hr. (*The figures were deleted by the censor.*)

For a period of 5 months the desperate struggle went on, the German artillery pounding every inch of the territory and the general staff ordering division after division to be thrown in, in a determined, reckless resolve to break down the French resistance at all costs. And during that time the French troops relied on the automobile service exclusively for bringing up reserves, taking away

Motor Trucks *on the* Verdun Front

Above—Part of a convoy of Pierce-Arrow trucks bringing up fresh troops to relieve those in the trenches in the Verdun sector

Below—The ground near Verdun is honeycombed with dugouts and padded with sandbags. This illustration gives an idea of its desolate appearance

Above—Motor trucks in the Verdun district operating in sections of five. No stoppages are permitted and a uniform speed of 9½ m.p.h. is maintained. This section system was adopted for the benefit of ambulances and officers' and telegraphic cars

Below — Drivers of cars and trucks, not being allowed to park along the roads to Verdun, were obliged to park their vehicles in the open country

Convoy of Pierce-Arrow trucks taking troops back from the trenches to resting points behind the line

the remnants of battalions, for supplying the artillery, for bringing up food and water, and for removing the wounded. The army was served perfectly: there was never a hitch, never a delay, never a call for more reserves which was not met by the automobile service until the time when the attack was broken and the stubborn French army had driven the Crown Prince's forces out of most of the positions he had been able to secure at overwhelming cost.

General Traffic Director in Charge

Naturally the automobile service was not confined to the Bar-le-Duc-Verdun road, although it was here that the greatest activity was displayed and automobiles triumphed over all other forms of locomotion. The whole of the region occupied by the Second Army, the one chiefly involved by the attacks on Verdun, was divided into two main sections, and each section was in command of a general traffic director invested with full powers from the general in command of the army. The traffic director was responsible for road-policing, traffic in villages and at cross-roads, the erection of direction posts, the creation of one-way circuits wherever necessary, the building of bridges, the placing of artillery and engineers' parks, the necessary precautions to be taken when roads were under fire, the control and efficiency of the narrow track light railroad.

One-Way Routes

Right up to, through, and beyond Verdun one-way routes were established in the great majority of cases. In a few cases only was it possible to restrict the use of roads to automobiles; in other cases, horses and automobiles had to make use of the same road, still under the section system of five trucks and eight horse vehicles, while cavalry and foot traffic were kept off. Certain roads, leading to important batteries, were closed to all but trucks taking ammunition to those batteries. In other cases, where the road surfaces were very poor, only four-wheel-drive artillery ammunition tractors were allowed, ordinary trucks being kept off.

Supply trucks carried ammunition either direct to the batteries or to dumps at convenient positions somewhere in the rear, from which place it would be taken up in smaller quantities by horse or by hand, according to circumstances. Every condition was provided for by the general traffic inspector. Certain roads were closed to everything and everybody during daylight hours. To appear on these roads meant instant death; thus, so long as daylight lasted they were deserted, and the enemy could only guess what use, if any, was made of them after nightfall.

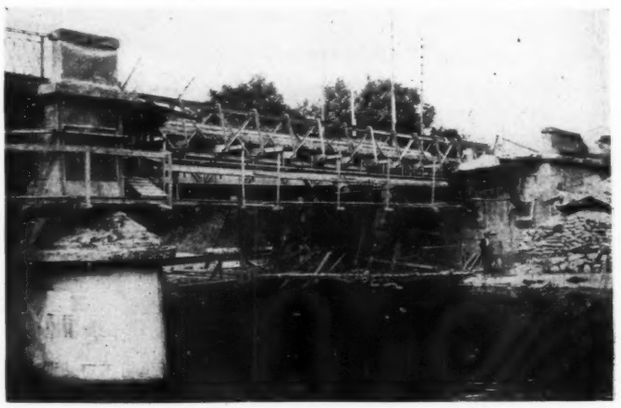
In the next category were roads forbidden to all vehicles, only small groups of men afoot being allowed over them.

In section three were roads closed to all vehicles except touring staff cars and ambulances, which, of course, ran over them singly and not in groups. These roads were essentially dangerous, for most of them were not only under artillery but subjected to rifle and machine gun fire. When a driver ventured on such a road he knew that he would be fired at, and his only hope lay in being able to just slip through between the shells. Whether he was bringing back wounded, carrying officers, or transporting telegraphic material and telegraphers—these being the three types of cars going to the nearest front—his chances were about the same.

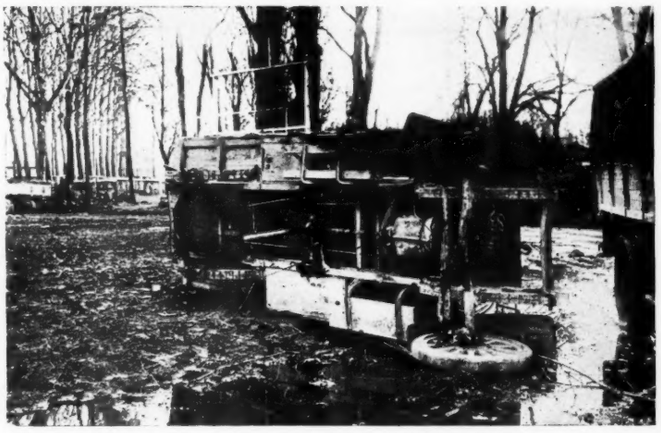
One ambulance section of twenty automobiles and forty drivers which went through the most bitter portion of this Verdun struggle lost ten of its vehicles and had twenty of its men killed. At an early stage one of the ambulances carrying six wounded men was hit by a shell and every man aboard was killed. For several weeks the wrecked ambulance and the mangled remains of its occupants remained by the roadside and were occasionally fired at by the enemy. Day after day the others went by that tragic spot, unable to stop for a second; one after another they fell, but the automobile ambulances never once failed to go up for the wounded when the call came.

Automobile Service Aids Civilian Evacuation

When the fate of the City of Verdun hung in the balance orders were given for the entire civilian population



Bridge over the Meuse in a suburb of Verdun. This illustration shows one of the temporary bridges that cars and trucks have to cross



The illustration at the left shows how wrecked trucks were levered off the road during the great attack on Verdun. That at the right depicts an abandoned touring car wrecked on the same road

to be evacuated. This was additional work for the automobile service, for the railroad had long ceased to run to the battered city. After the removal of the civilians, and while the town was under heavy shell fire, arrangements were made for saving as much of the household furniture as possible. This was additional work for the automobile service. Gangs of soldiers who had experience in removing were kept in the town and packed the household goods. At night-time automobile trucks moved up to the appointed places, where they found the goods ready to be loaded, and a short time later they moved away to some town in the rear, or to a railroad depot from which the goods would be shipped to their owners. In this way thousands of dollars' worth of valuable furniture was saved, which would otherwise have been totally destroyed under the enemy bombardment.

Instant Road Repairs Necessary

This intense automobile road service had to be carried out during the most unfavorable months of the year—January, February, March, April—when roads are generally in the least satisfactory condition. There were available for use into Verdun one third-class road, reserved for automobile traffic, one national highway, or first-class road, and a certain number of minor roads not much better than the average American dirt road. The two main roads, which had to carry the great bulk of the traffic, were under frequent shell fire, the extreme portions of them being untenable. This brought up serious problems of repair, for while the first-class road was overloaded several hundred per cent, the third-class highway carried an amount of traffic it was never dreamed possible it could support. The only method of keeping it in repair was to have road repair men at intervals of every 20 yd. with instructions to dump material into the holes as quickly as they were formed. The only rolling that was possible was done by the vehicles as they passed up and down the road. Where shell holes were formed, the same general system of repair was adopted, the wreckage from buildings frequently being employed to fill up the holes.

While keeping the surface in the best possible condition under the circumstances, the road repair men widened the road wherever it was possible to do so. Wherever a grass bank existed it was unturfed, covered with stones, rolled and added to the main road. Whereever possible, too, bridges were widened to the full width of the road, so that there would be no bottling of traffic. This rough-and-ready method of repair proved very satisfactory, the roads remaining in good condition throughout the operations and never being directly responsible for the breakdown of trucks or the delay of convoys.

One of the traffic rules forbade the use of chains on driving wheels of trucks using the main roads. Traffic police had definite instructions to stop the driver of any truck using chains and order their removal. As every truck bore clear identification marks, there was an obvious remedy against drivers who sought to evade the general regulations.

10 Per Cent of Trucks Under Repair

Apart from losses due to direct shell fire, which losses are variable and difficult to estimate, the percentage of trucks under repair during such active service as the great German attacks on Verdun was about 10 per cent. The same percentage held good for ambulances. This included repairs which were done by the traveling workshops attached to the convoys, as well as the bigger breakdowns and overhauls which were only treated by the permanent repair bases. Although on the automobile road trucks were subdivided into sections of five, the real unit was twenty trucks, one of which towed a kitchen, and another carried spare parts and tools. One complete automobile workshop was attached to four or five groups of twenty each, or one workshop for eighty or 100 trucks.

Finer Repairs on Touring Cars

It is difficult to estimate the percentage of repairs in touring car work, for these vehicles generally operate singly. The loss, however, is less than for trucks, which may be explained by the fact that generally the drivers are more experienced, and that the greater silence of a touring car makes it possible to detect a defect before it has developed to a dangerous degree. The general volume of sound arising from a loaded truck makes it difficult for any ordinary driver to detect a warning noise.

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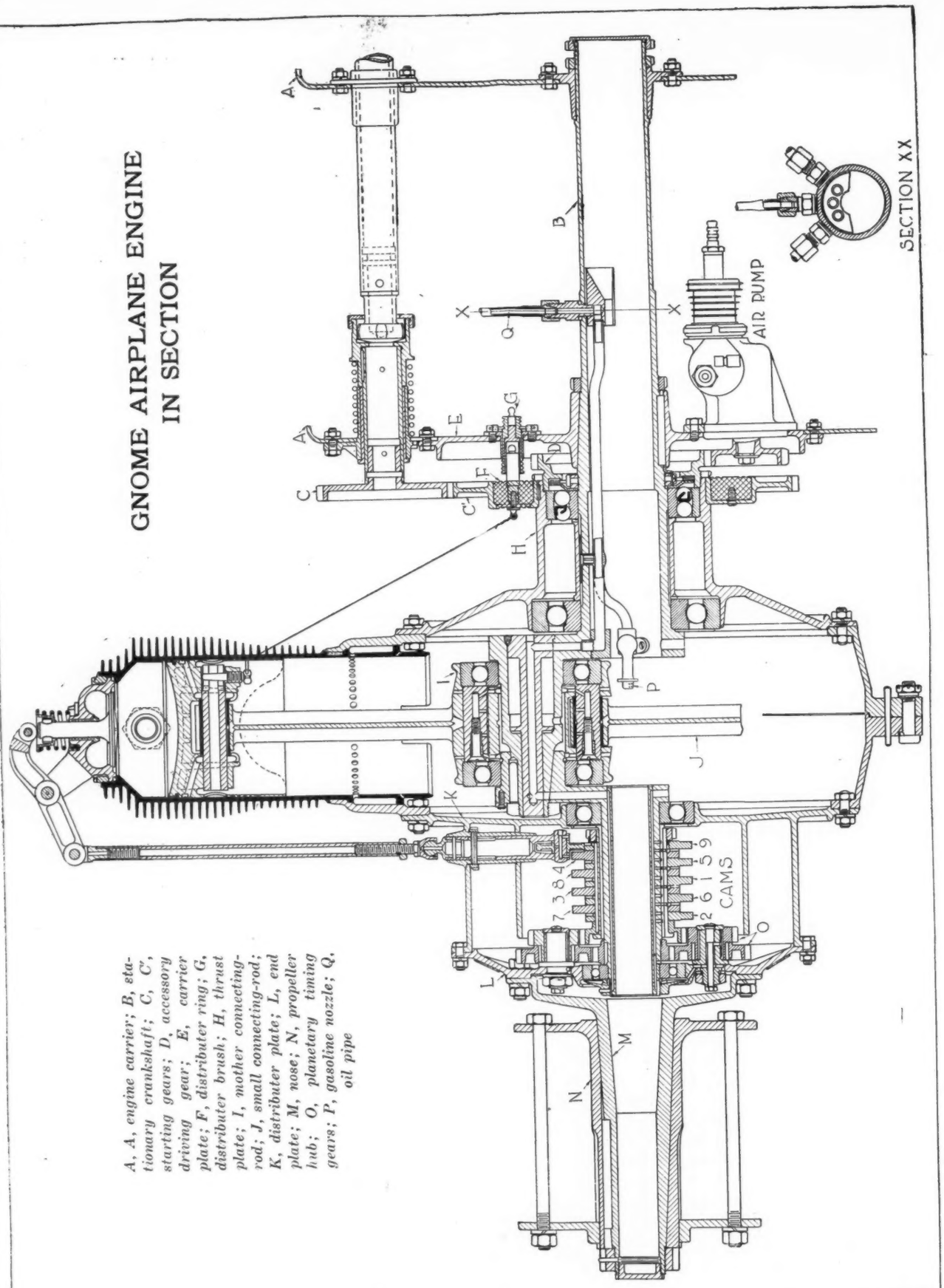
Periscopes for Armored Cars

LOUIS DISBROW of the Disbrow Motor Car Corp. has designed periscopes for sighting the Lewis guns which will be carried on armored cars to be used for dispatch purposes. These periscopes will provide views for the drivers both ahead and behind and along the sides of the car. There will be three periscopes and the driver can be completely inclosed yet witness every action outside the car. There will also be a slit in the armored body through which observations can be made under ordinary circumstances. In case of danger this slit can be closed and two doors are provided to be swung V-shape in front of the radiator to provide complete protection for the driver and the car.

GNOME AIRPLANE ENGINE IN SECTION



A, A, engine carrier; B, stationary crankshaft; C, C', starting gears; D, accessory driving gear; E, carrier plate; F, distributer ring; G, distributer brush; H, thrust plate; I, mother connecting-rod; J, small connecting-rod; K, distributer plate; L, end plate; M, nose; N, propeller hub; O, planetary timing gears; P, gasoline nozzle; Q, oil pipe

Building Gnome Airplane Engines

Part II

Production Methods Employed in Turning Out the Crankshaft, Pistons and Connecting Rods—Inspection Methods and Tests of the Complete Engine

EDITOR'S NOTE.—This is the second of a series of articles which will deal exhaustively with the different types of airplane engines now being produced in the United States, both from the standpoint of design and that of manufacture. In view of the great demand for airplanes for the Army and Navy, many of the large automobile plants of the country, in addition to existing airplane factories, will shortly be devoted to the production of airplane engines. The subject is therefore one of unusual timeliness.

By P. M. Heldt

BALL bearings are used both on the crankpin and on the main journals of the engine. In order to get the crankpin bearings into place, the crankshaft is made in two parts, which are joined together by means of a long taper, a key and a nut. The main part of the crankshaft, which includes most of the crankpin, is keyed to the bearer plate, which fits into two pressed steel carriers mounted on the airplane fuselage. That portion of the shaft fitted into the bearer plate is tapered 1:10, and the plate is forced on by a nut. The crankshaft is drilled out so that only a comparatively thin wall remains. Its main part serves as a conduit for the oil and gasoline pipes and its short end carries a sleeve on which the cams for actuating the exhaust valves are mounted. The bearer plate above referred to carries the magneto, air pump and oil pump. These accessories are driven by a pinion secured into the hub of the thrust plate.

The crank forgings are first annealed and the main part is then drilled out to two different diameters at opposite ends—50 mm. at the outer end and 55 mm. at the inner end. The reason for the two diameters is that there are a good many shoulders and a taper on this part of the shaft, so that its outside diameter increases materially from the outer to the inner end, and if the shaft were bored out to a single diameter its wall would be unnecessarily thick at the inner end. Oil is carried through the crankshaft to the cams, but owing to the large bore in the main journals and the crankpin it is carried through small tubes in the main journal and through a hole in a core inserted into the crankpin. Two ball bearings are mounted on the crankpin, and the latter has to be ground to within the limits allowed for ball-bearing fits, which in this case are 50.00 and 50.02 mm.

Interesting Connecting-Rod Assembly

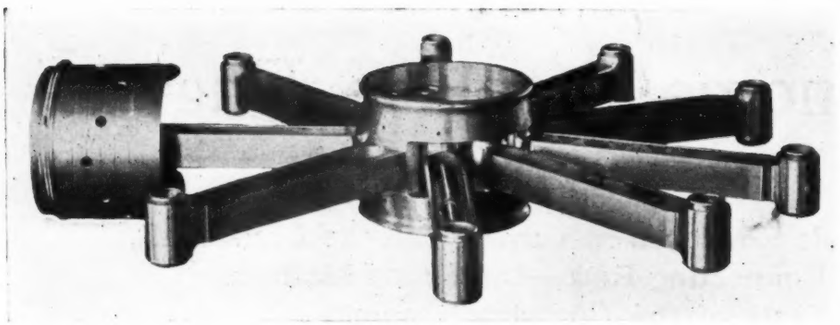
An interesting construction of connecting-rods is employed. There is one mother rod, or master rod, the big end of which is provided with cup-shaped enlargements on both sides into which fit the two ball bearings on the crankpin. The other eight rods are hinged to this mother rod, holes being drilled in the webs of the enlargements referred to. Owing to the fact that the motions of the mother rod and the small rods respectively are different, the system is not inherently balanced, and to overcome this the eight holes for the pins joining the small rods to the mother rod are drilled at different distances from the axis of the mother rod big end. All of the rods are forged from high-grade steel and machined all over. The quality of steel used is indicated by the rod shown in one of the photographs, which has been twisted through an angle of 180 deg. without showing the least fracture or other defect.

Mother Rod Shank Undercut

The mother rod has to be undercut in the shank near the big end, so as to prevent interference of the two small rods closest to it. This is a rather troublsome operation and is effected by means of a fixture on a rotary table in a vertical miller. The holes for the connecting-rod pins in the mother rod are first drilled, and after the rod is machined they are bored and reamed. These boring and reaming operations are performed by means of a fixture containing a bushing on top and a guide below, the drill or reamer floating in the tool holder, so as to insure that the hole will be absolutely true with the face of the rod. After the brass bushing has been forced into position it is reamed in a fixture by means of a reamer guided at both ends. The holes are then tested for parallelism, by inserting long rods in both, supporting the rod at one end in V blocks on a surface plate, and then by means of a multiplying indicator comparing the heights at opposite ends of the other rod from the surface plate. This is shown in one of the illustrations. The mother rod is tested in the same way, but instead of putting a supporting bar through the central hole in the big end, two bars are put through holes for symmetrically located pins for the smaller rods, by means of which the mother rod is supported on plain blocks.

Machining the Mother Rod

The first operation on the mother rod consists in roughing down the ball bearing seats, which is followed by drilling the hole through the center and removing stock from the outside of the hub. After all these operations have been performed on one side of the big end, they are repeated on the other side. Next the shank is rough-finished. Then the nine holes for the connecting-rod pins are rough-drilled, and additional stock is removed between the two ball bearing seats. Although only eight small connecting-rods are pivoted to the mother rod, nine holes are drilled in the latter, the extra hole being on the center line of the mother rod shank. As this hole is symmetrical with respect to the other eight holes it does not weaken the mother rod, and it results, of course, in a slight saving in weight. Next the forging is heat treated and it is then machined down to grinding size, first on one side and then on the other. The center hole is fin-



Assembly of mother connecting-rod and small connecting-rods, with a piston in place on the mother connecting-rod

ished in the same operation. Next the web of the shank is milled and then the slot in the rod between the halves of the head is also finish milled. Next the nine similar holes are finish-bored and reamed, the same method being employed as with the small rods to insure absolute accuracy.

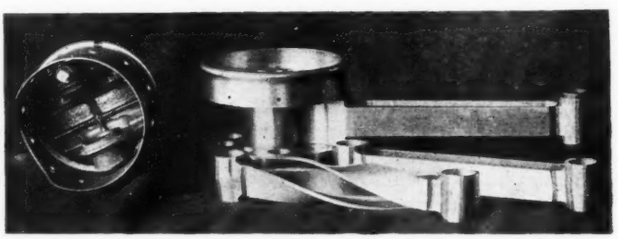
The small end is then finish-bored and reamed, this operation also being performed by means of a jig which guides the tool at both top and bottom, and with a floating tool. The brass bushing is now forced into the small end, and the mother rod is then ready for the parallelism test described in the foregoing.

The eight wristpins are keyed in the mother rod and have bronze-bush bearings in the small rod. Elaborate provisions are made for insuring effective lubrication. Circular oil grooves are cut on the inside of the enlargements of the mother rod big end in which the ball bearings are fitted. Radial holes lead from these grooves to the surface of each wristpin, and inclined holes in the wristpin to the center thereof, which is made to form a double oil chamber by drilling it out and counter-boring it to four different diameters, and inserting a flat-head screw which closes the end and divides the interior into two compartments. Each compartment communicates with the oil groove in the bronze bushing through a radial hole. Thus there are virtually two separate oil supplies to these bearings.

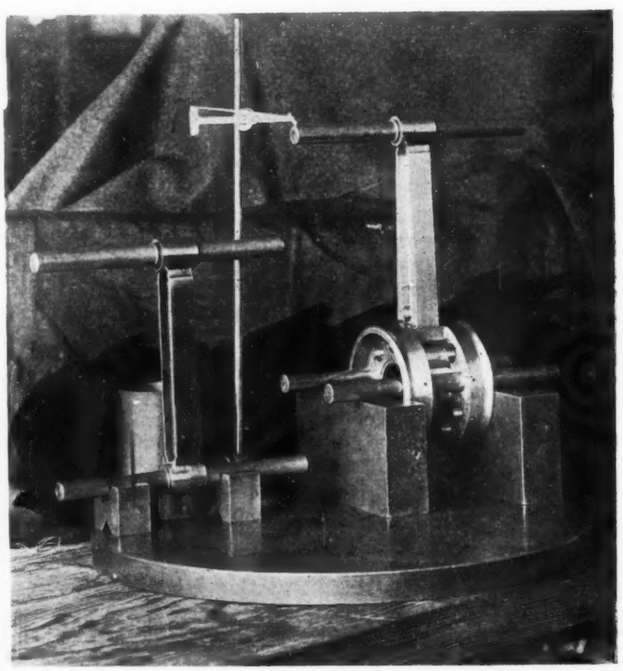
Machining of Pistons

The pistons are made of gray iron castings of an unusual fineness of grain. The first operation on receiving the castings consists in sand blasting them, so as to remove all core sand. The first machining operation is to rough-turn the outside, and this is followed by the facing of the head, with the exception of the center boss. The head, as will be seen from the illustrations, is slightly cupped. Next the piston is turned out on the inside, which is done in a turret lathe. The piston is of unusual design in that the piston pin lugs are not cast on the skirt but are connected with the piston head. The lower part of the piston, 62 mm. long, is turned down cylindrically, to within the limits of 109.80 and 109.87 mm. The diameter of the top end of the piston is made between 109.67 and 109.72. The bore of the piston at the open end is 107.50 mm., leaving wall thickness of less than 1.25 mm. or 0.050 in. The bore tapers and at the top end it is 106 mm. in diameter, leaving a wall thickness of less than 2 mm.

One regular piston ring and one obturating ring are used on each piston. The latter is at the extreme upper end of the piston and is so arranged that the gas pressure forces it against the cylinder wall and the land at the bottom of it. This ring is of angle-shaped section. An oil groove is cut in the regular piston ring, and there is also an oil groove in the piston directly below the groove in which this ring is located. Two inclined oil holes run from the bottom of the ring groove at opposite points of the circumference through the piston bosses to the inner end thereof. Formerly the piston pin bearings were lubricated through small oil tubes leading up alongside the connecting-rod shank, and some of the photographs show this construction. These have been dispensed with, however, and now two holes are drilled through the small end of the connecting-rod from the under side. Owing to the centrifugal force, any oil that gets onto the connecting-rod or the cylinder wall tends to flow toward the outer end of the cylinder. There are also five oil grooves cut on the skirt of the piston, and ten oil holes are drilled through the wall of the skirt, these lying on the three intermediate oil grooves. In order to obviate interference between the pistons of adjacent cylinders it is necessary to cut away a part of the skirt of each piston on one side. The piston pin is secured in place in the piston boss by means of



Showing the mother connecting-rod and a couple of small connecting rods, one of which has been twisted through a half revolution to bring out the quality of material used. Also a view of a finished piston

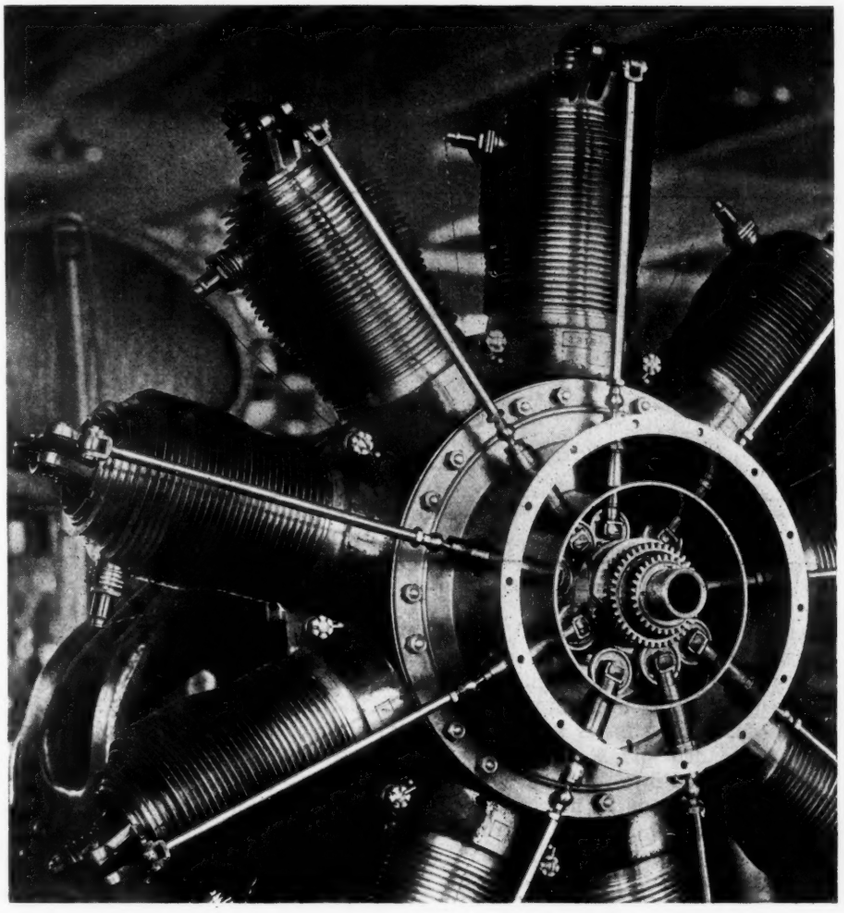


Testing for alignment of the bearings of the mother connecting-rod by means of a multiplying indicator, test bars and blocks on a surface plate

a pin screw, the end of the piston pin being split and expanded tightly in the piston boss by the tapered pin.

For grinding the piston it is pressed with its open end against a face plate with a circular shoulder on it, and the tail stock is brought up against the center at the closed end. At this point in the fabrication of the pistons the open edge is still square, the cutting out of one side being left to the last. All pistons are carefully weighed on a special scale to insure an accurate balance. The tolerance in weight is only 10 grams, or one-fiftieth of a pound. A shifting weight which the piston must balance can be moved between limits on the scale beam.

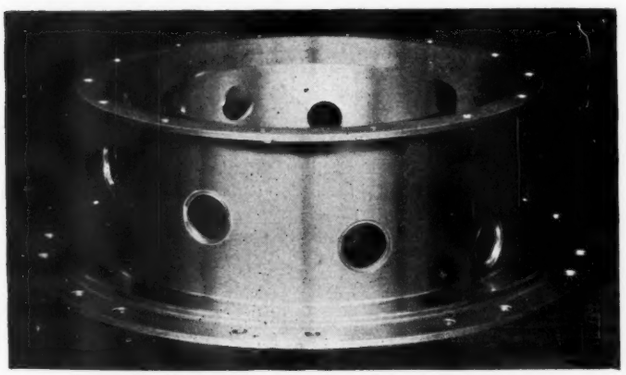
In addition to the two main parts of the crankcase, the manufacture of which has already been described, there are two end plates, which are known as the thrust plate and the distributer plate respectively. The distributer plate, which forms a housing for the cam gearing, is made from a forging, and as it comprises two concentric flanges several inches wide, which have to be turned up out of the solid, it involves an enormous amount of machine work. The original forging weighs 201 lb., and this is reduced by the machining processes to 15½ lb. This distribution cover is provided with an outward radial flange at its forward side to which is bolted the front end plate. A ball bearing is inserted in the hub of this end plate and rides on the forward end of the crankshaft. The front plate carries two studs, on each of which there is a pair of planetary pinions, meshing with a stationary pinion on the crankshaft and a pinion on the sleeve carrying the cams. The six pinions in this set are so proportioned that the cam sleeve turns in the same direction as the cylinders and at half speed.



Distributer end of the assembled engine, showing the timing gears, cams, push rods, etc.

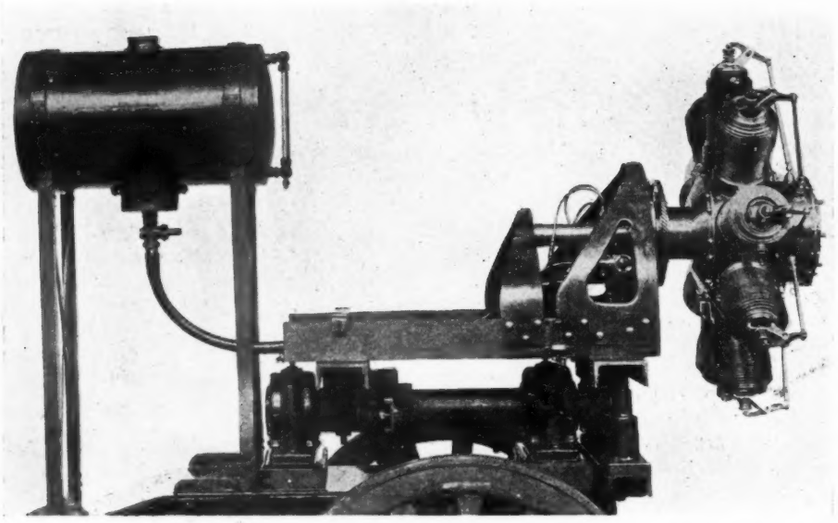
One Cam Per Cylinder

There are nine cams—one for each cylinder. All cams are exactly alike, except for the position of the key-way. The cams are cut from bar stock, which is cut off to a certain width. Then a hole is drilled through the disk thus obtained, the outside circumference is turned and one side faced off with a slight shoulder, these operations being performed in a 4¼-in. Gridley automatic. Next the other side of the cam is faced off in a Jones & Lamson lathe, and the key-way is then broached. A lot of these disks are then mounted on an arbor and some of the material opposite the cam lobe is milled off, so as to reduce the amount of work for the cam-cutting machine. Next a radial oil slot is milled in the side of each cam, and after this operation the cams are cut to size in a Garvin cam-cutting machine, which makes use of a master cam three times actual size. After this the cams are numbered and stamped. As each of the nine cams must have the cam lobe located differently with relation to the key-way, the master cam is provided with nine equally spaced slots by means of which it can be set in different positions relative to the arbor. After this operation the cams must, of course, be kept in sets having the same relation between key-way and cam lobe.



The finished distribution plate. This is made from a forging weighing 201 lb. and when finished weighs only 15½ lb.

The cams are next hardened and their sides are ground in a ring grinder with magnetic chuck. After the hole has been ground out they are put on a cam-grinding attachment and the outside of the cam is ground to the exact size. The limits for the hole in the cam are 54.98 and 55.00 mm. and the width of the cams is also closely limited. Plug and snap gages are used to determine the accuracy of the parts. Owing to the fact that the valves are held off their seats by the cams for more than a complete revolution of the engine, the cams are of very unusual form. The lifting and closing inclines also are of different shape. These cams are made of steel having



Gnome revolving engine mounted on wheeled test stand. This test stand comprises two pressed steel carriers similar to those which support the engine on the airplane, and a frame mounted on ball bearings for determining the torque

a tensile strength of 264,000 pounds per square inch.

A very interesting part of the machine consists of the valve push rods and their guides. Roller cam followers are used and are secured into the lower ends of the hollow push rods. These latter at the upper end are provided with ball-ended plugs, connecting with hemispherical sockets, screwed into the lower ends of the tubular tappet rods. There is a check nut on the stem of these sockets, and the latter are provided with an hexagonal portion to which a wrench can be applied, so that adjustments can be readily made. The push rods are slotted, and a pin is passed through these slots and secured in the push rod guide, thus insuring that the roller will always remain parallel with the cam. A very fine fit is required for the push rod guide in the distributer plate. The guide has a seat in both the outer and inner flanges. The guide itself is provided with a flange which sets into a depression formed in the outer flange of the distributer housing and is clamped tight in position by means of a nut. It also has a tapered seat in the inner flange of the housing, and the dimensions must be so accurate that when it is clamped tight in the outer flange by means of the nut there will also be a tight fit in the inner flange. The different push rods are located in the distributer housing on a helical line, so as to bring the different cam rollers in line with the corresponding cams.

For lubricating the cams a sleeve is inserted into the forward main journal of the crankshaft, and is undercut on its outer surface so as to form an oil reservoir which is in direct communication with the oil supply from the pump through the tubes and passages in the crankshaft. Radial holes are drilled through the wall of the crankshaft journal, which register with circular oil grooves in the bushing of the cam sleeve. Holes are also drilled through this bushing and through the cam sleeve, and each of the cam disks has an oil groove cut in one face. Hence each cam receives a direct supply of lubricant. The exhaust valve is of the caged type, the cage, together with the bracket for the valve tappet, being made from a drop forging. Both the valve stem and the spring are very short, and the spring is rather weak as compared with springs on the valves of conventional engines, this being due to the fact that the centrifugal force on the valve has a strong tendency to hold it closed, hence little spring force is required for closing it. One advantageous feature of the cycle of operations is that as most of the air entering the cylinder passes through the exhaust valve, the latter is effectively cooled. The cage rests on a gasket and is held in position by a threaded ring nut provided with slots to take a wrench.

To the front cover is bolted a part known as the nose, to which the propeller hub is secured. This nose is made in three different designs—short, intermediate and long—to suit different types of propellers and planes.

Fuel System

Gasoline is fed to the engine by means of air pressure at 5 lb. per sq. in., which is produced by the air pump on the engine. A pressure gage convenient to the operator indicates this pressure, and a valve enables the operator to control it. No carbureter is used. The gasoline flows from the tank through a shut-off valve near the operator and through a tube leading through the hollow crankshaft to a spray nozzle located in the crankcase. There is no throttle valve, and as each cylinder always receives the same amount of air as long as the atmospheric pressure is the same, the output cannot be varied by reducing

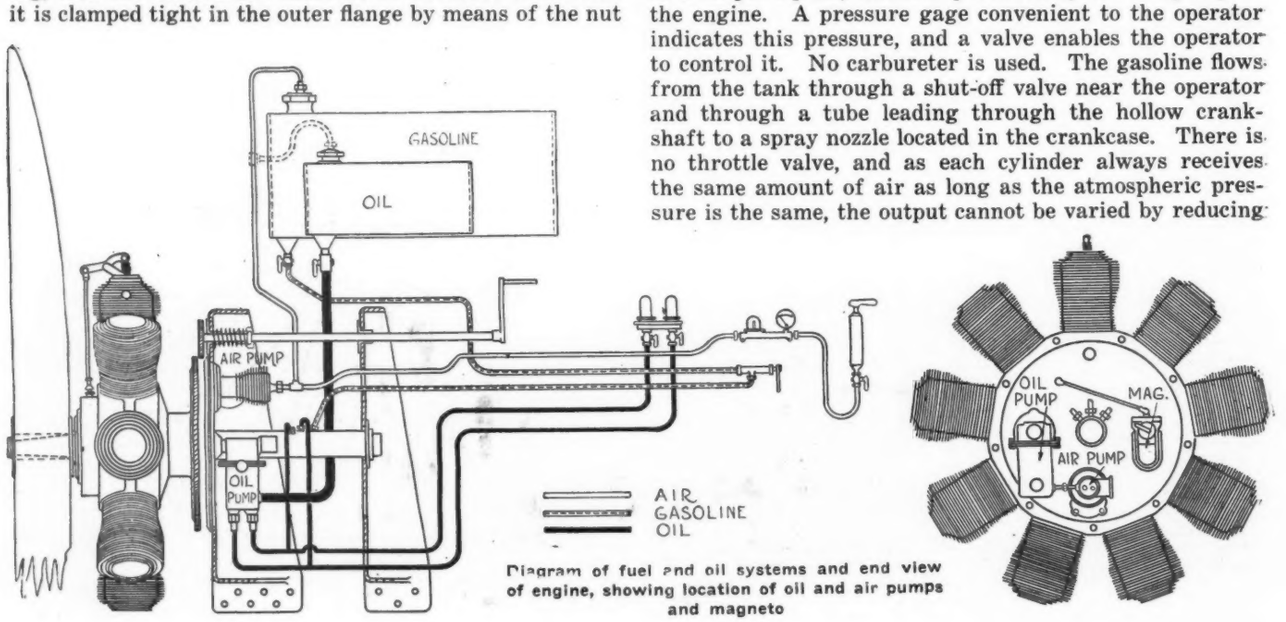


Diagram of fuel and oil systems and end view of engine, showing location of oil and air pumps and magneto

the fuel supply, except within narrow limits. A fuel capacity of 65 gal. is provided. The fuel consumption is at the rate of 12 U. S. gallons per hour.

Ignition by a Single Magneto

The high-tension magneto is located on the thrust plate in an inverted position, and is driven at such a speed as to produce nine sparks for every two revolutions; that is, at 2¼ times engine speed. A Splitdorf magneto is fitted. There is no distributer on the magneto. The high-tension collector brush of the magneto is connected to a distributer brush holder carried in the bearer plate of the engine. The brush in this brush holder is pressed against a distributer ring of insulating material molded in position in the web of a gear wheel keyed to the thrust plate, which gear serves also for starting the engine by hand. Molded in this ring of insulating material are nine brass contact sectors, connecting with contact screws at the back side of the gear, from which bare wires connect to the spark plugs. The distributer revolves at engine speed, instead of at half engine speed as on ordinary engines, and the distributer brush is brought into electrical connection with each spark plug every time the piston in the cylinder in which this spark plug is located approaches the outer dead center. However, on the exhaust stroke no spark is being generated in the magneto, hence none is produced at the spark plug.

Ordinarily the engine is started by turning on the propeller, but for emergency purposes a hand starting crank is provided. This is supported in bearings secured to the pressed steel carriers of the engine and is provided with a universal joint between the two supports so as to prevent binding of the crank in the bearings due to possible distortion of the supports. The gear on this starting crank and the one on the thrust plate with which it meshes are cut with helical teeth of such hand that the starting pinion is thrown out of mesh as soon as the engine picks up its cycle. A coiled spring surrounds part of the shaft of the starting crank and holds it out of gear when not in use.

Lubricating oil is carried in a tank of 25-gal. capacity, and if this tank has to be placed in a low position it is connected with the air-pressure line, so that the suction of the oil pump is not depended upon to get the oil to the pump. From the bottom of the oil tank a pipe leads to the oil pump inlet. There are two outlets from the pump, each entering the hollow crankshaft, and there is a branch from each outlet pipe to a circulation indicator convenient to the operator. One of the oil leads feeds to the housing in the thrust plate containing the two rear ball bearings, and the other lead feeds through the crankpin to the cams, as already explained.

Owing to the effect of centrifugal force and the fact that the oil is not used over again, the oil consumption of a revolving cylinder engine is considerably higher than that of a stationary cylinder engine. Fuel consumption is also somewhat higher, and for this reason the revolving cylinder engine is not so well suited for types of airplanes designed for long trips, as the increased weight of supplies required for such trips, as compared with stationary cylinder type motors, more than offsets the high weight efficiency of the engine itself. But for short trips, and especially where high speed is required, the revolving cylinder engine has the advantage. The oil consumption of the Gnome engine is as high as 2.4 gal. per hour. Castor oil is used for lubrication.

Attention may be called to the provisions made for preventing loss of oil from the crankcase. Just in front of the forward ball bearing on the crankshaft there is an oil guard of the type which flings off any oil collecting on it from a sharp edge, into an oil groove, whence it can return by gravity to the crankcase. At the rear end, directly behind the rearmost ball bearing, a packing is provided which makes the crankcase oil tight at this point. This ball bearing, it will be observed, is of the two-row type and takes the thrust of the propeller.

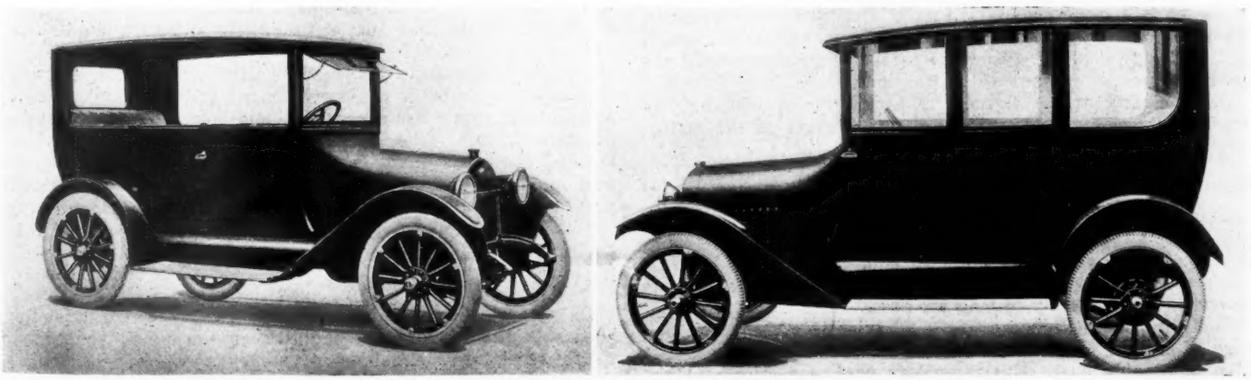
Assembling and Testing

In assembling the engine the main part of the crankshaft is first put in place in the cylinder and crankcase assembly. The mother rod with its piston is then placed on the crankpin, and each of the smaller rods with its piston is in turn connected to the mother rod. Next the small part of the crankshaft with its ball bearing is secured to the main part, and then the distributer plate is bolted to the crankcase.

Tests of the engine are made by means of a fan secured to the nose in place of the propeller. The carrier plates are secured to a frame mounted on ball-bearing trunnions on a wheeled carriage similar to a gun carriage in appearance, which can be secured in place on the floor by dropping its tail end over a bolt in the floor. A lever can be secured to the frame and the torque measured on a balance. Every motor is run under load for 3 hr. It is then taken apart and thoroughly examined, and after being reassembled it is given a final test of 20 min.

The weight of the Gnome engine, with magneto but without supplies, is 272 lb.

Two New Chevrolet Sedan Models



At the left is the F-A sedan on the 108-in. chassis, selling at $1,475, and at the right is the Four-Ninety sedan, mounted on the 102-in. chassis, listed at $1,060. Both are five-passenger models

Steels Used in Airplane Work—I*

Emphasis Is Laid on Necessity for Airplane Designers Having Thorough Knowledge of Properties of Various Grades of Steel and of Effects of Heat Treatments

By Dr. W. H. Hatfield

THIS paper deals with the uses of steel in aeronautics and it is proposed to commence by indicating two essentials: 1—The use of high class material; 2—Scientific methods in works practice.

High quality not only influences the composition of the final steel but also directly influences the method of production. The best materials are usually the most expensive and hence the more expensive the material the greater will be the care taken in the production of the steel of which it forms the base. To begin with, it is undesirable in special alloy steels that the sulphur and phosphorus should exceed relatively low limits; particularly does this apply to sulphur, since any sulphur which is present is present not really in the steel, but as a sulphide of manganese "mixed" with it as a separate non-metallic inclusion readily observed by the microscope, and these non-metallic inclusions—*i.e.*, sulphides, slags, etc.—have quite a serious influence in particular circumstances.

Knowledge of Materials Essential

With regard to the necessity for scientific methods in works practice, if engineers responsible for the building of airplanes, aero engines, etc., are to obtain anything like the best results from the materials which are now available, it is necessary that they shall have some appreciation of the characteristics and properties of those steels. They should understand the reason for the various heat treatments, and should also appreciate the considerations which lead to the selection of any particular one as the means of placing the steel in the final condition in which it may be expected to do the best service. It will be apparent that accurate heat treatment, based upon the definite thermal phenomena associated with each particular steel, is essential, and this necessitates, in works practice, the use of satisfactory and properly standardized pyrometers. Having obtained satisfactory pyrometers, it is necessary to learn to use them intelligently, and the author here points out that it is not enough to know that the pyrometer gives a correct reading when placed into a certain temperature.

What is still more important in this connection is that the temperature recorded truly represents the heat of the part which is being heat treated. That brings us to a consideration of the types of furnaces which may be employed, and here again it is necessary to use the very best types and the most efficiently constructed and worked furnaces if homogeneous results are to be anticipated in the final product. Later in the paper there are a number of very essential points which will arise quite sufficient to make further emphasis totally unnecessary as to the necessity of scientific methods. It will be quite clear that the engineer responsible for producing airplane parts should have a sound appreciation of the metallurgical side of the business.

Duties of Various Parts

Before proceeding with a discussion of the constitution and properties of the steels employed in aero work, it is desirable to make a few comments upon the duties the parts have to perform, factors of safety, and lastly, on the means employed in mechanically testing the steel. The last item is extremely important, since every mechanical test is in the nature of a test to destruction, and if properly studied will give invaluable data with regard to the properties and behavior of the material under stresses, normal and abnormal, which are likely to be encountered in practice.

In deciding the class of material suitable for the various parts of any machine or structure, it is necessary to take very carefully into consideration the nature of the stresses which the parts have to withstand and the conditions under which they are called upon to work. Generally speaking, it is possible to divide them into two broad classes:

1—Parts subjected to stresses of a known nature and of fairly determinable magnitude.

Load Is Constant

These include steady, intermittent, and alternating stresses, and the parts concerned are those which have to take up the weight of the structure or to transmit forces directly consequent upon the generation and utilization of power.

2—Parts subjected to sudden stresses of unknown magnitude, generally described as "shocks."

In applying this method of division to airplanes, it would appear that, whilst the wings and framework of the machine as a whole may be subjected to stresses of the second class, such stresses can be, and are, to a large extent eliminated from the power plant. The aero engine, whether on the ground or in the air, is not liable to such sudden changes of load as a motor car engine (owing to the fact that the engine and propeller can run at speeds not in a direct ratio to the forward velocity of the airplane), and, incidentally, there is the absence of change gears. Comparatively light "shocks" are suffered by the valves, and their driving mechanism (cams, camshafts, and tappets), and also by the valve seating.

The wheels and landing chassis, and, in a lesser degree, the fuselage and wings, are subject to shocks, although for the latter the spring suspensions transmit the forces more as live loads than as real shocks.

Returning to the parts subjected to the first class of stress, the demand made upon these is very high. Not only do the stresses fluctuate considerably, but some of the parts, such as cylinder and piston, have at the same time to withstand high temperatures as well as abrasion. All parts also have to encounter low temperatures, and as to exactly what low temperatures have to be encountered when the planes are up at high altitude in cold weather, the author said he would like to receive information during the discussion.

It is generally accepted that parts not subjected to shock should be produced with material having essentially a high elastic limit with just sufficient ductility to insure non-brittleness, whereas for parts subjected to severe shock toughness is the more important feature. The division between the two classes of stresses is not very sharp, and in many cases a compromise would appear to be made between the two types of matrial. Bearing on this, it should always be remembered that all the parts under consideration are of relatively small section and lend themselves to very careful heat treatment, and the steels are worth studying with a view to determining exactly what properties can conveniently be introduced into such sections.

Rigidity of Parts a Factor

In general design there is another quality which must not be lost sight of, *i.e.*, the rigidity of the parts concerned. Parts which are not subjected to very great forces, such as the crankcase in a good design, must not have their dimensions so reduced as to make them very liable to change their shape. A high-tensile material in such a case is unnecessary,

*Paper presented to the Aeronautical Society of Great Britain, slightly condensed.

it being preferable to use a light alloy and increased dimensions. (Modulus of elasticity in steel varies very little indeed by hardening, tempering, or by modification of composition within the limits of those steels used.)

The "modulus of elasticity" of the material employed is a determining factor in the question of rigidity. A lower value of the "modulus" means a greater elastic deformation under a given applied force, *i.e.*, a reduction in "stiffness," unless the dimensions are also modified. Considering, for example, a flat portion of the shell of the crankcase having uniform thickness, the "stiffness" of this part to resist forces applied at right angles to it is proportional to the cube of the thickness, while its actual strength is only proportional to the square of the thickness. These laws will apply approximately to the strength and stiffness of the whole crankcase.

Thus, suppose a steel casing is replaced by one of aluminum alloy of twice the thickness, and suppose the safe stress of the latter in tension is one-third of that of the steel; then taking the values of specific gravity as 7.8 and 2.8 respectively and those of Young's modulus as 14,000 and 4700 tons per square inch respectively, a flat portion of the aluminum alloy casing would have .718 of the weight, 1.33 times the strength, and 2.66 times the stiffness of those of the corresponding part of the steel casing.

A judicious insertion of "stiffening" webs on such a casing greatly adds to its rigidity.

Comments upon Factors of Strength

It has been pointed out on many occasions that the use of the term "factor of safety" is misleading, and yet the erroneous use of this term still continues. It would appear that a true "factor of safety" should be the ratio between the stress which may be safely applied indefinitely under the actual working conditions to the stress actually employed, and not the ratio of ultimate stress of the material under a static test to stress thought to exist in practice, as calculated from imperfect data combined with many doubtful assumptions. This latter ratio, whilst very useful in formulating empirical rules, should really come under a very different name, such as, for instance, "factor of contingency," already proposed by Mr. Lanchester.

Values Found by Trial

The actual values of this factor, employed in modern design, have been arrived at largely by the method of trial, and it is suggested that better results might be obtained, and fewer mysterious failures result, if the various contingencies to be allowed for are carefully examined and the "factor" placed on a more definite basis. A few of these contingencies may be mentioned. In the first place, we may consider low elastic limit as compared with maximum stress. The difficulty of measuring the true elastic limit militates against this

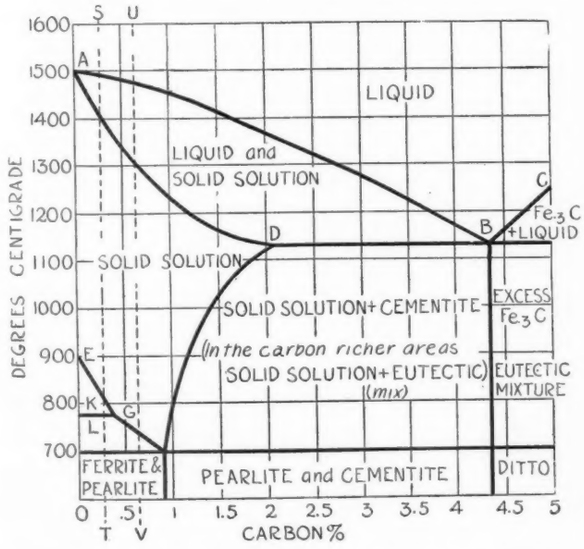


Fig. 1—Iron-carbide diagram showing phases in equilibrium

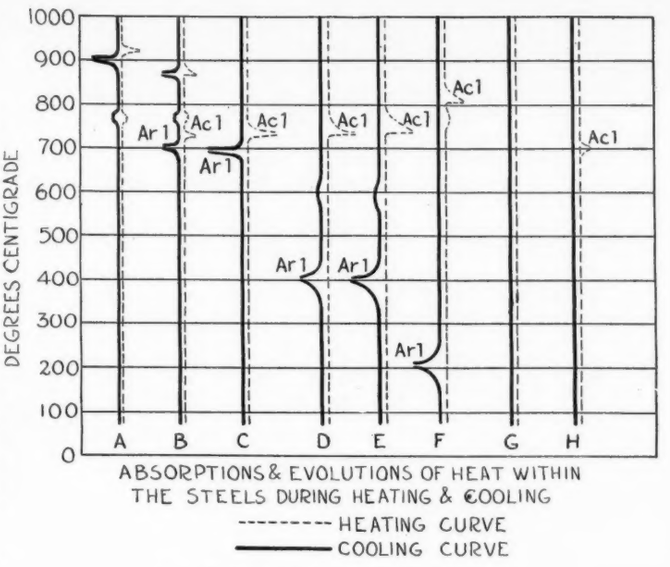


Fig. 2—Heating curve—cooling curve
A, pure iron; B, case hardening carbon steel; C, carbon steel; D, nickel chromium high tensile steel; E, air hardening nickel chromium steel; F, stainless steel; G, 25 per cent nickel steel; H, manganese steel

fundamentally important figure being determined as frequently as it should be, and, whilst mentioning this, the author would say that our ignorance as regards the properties of steels below the yield-point is considerable, whilst of the properties between the yield and the breaking stress it is still greater. The Wohler phenomena also merit the most careful consideration. The rapidity of load is also extremely important. Variation of temperature, too, has a recognizedly marked influence upon the physical properties of steel, whether reference is made to high temperatures or to low temperatures, and influence of the ranges of temperature to which the parts have to be submitted in practice should be carefully studied as regards the effect upon the properties of the several steels under consideration and more use made of metallurgical research in this direction. Unequal distribution of stress, particularly near the shoulders, is a well-worn theme. It cannot be too often insisted that sharp corners, or shoulders with fillets of small radius, are bad design. Their evil effects are more marked under repeated stresses than under steady stress. The strength of a member may be reduced 50 per cent or more due to this cause. The reason is that local deformation may occur which is deadly when alternating stresses have to be incurred. Corrosion might also be carefully and profitably considered, particularly as regards seaplanes, where salt water has to be taken into account. Other items which appear to require more attention than they do receive are:

1—The internal stresses left after forging and probably also after heat treatment.

2—Non-uniformity of material. This particularly applies to non-uniform conditions produced in the materials by unskillful methods of manufacture and heat treatment.

3—Non-reliability of material is extremely important, and it should be borne in mind that here the methods of production and the care which should be taken by the steelmaker are the important factors; inclusions of slag, exaggerated sulphide inclusions, defects caused by unsatisfactory treatment in the forge, and last, but not least, hardening cracks.

Engineer Must Consider Materials

These items are extremely important, and admittedly, with possibly the exception of the last-mentioned one, outside the control of the engineer, but at the same time they should be taken very seriously into account, more from the standpoint of insisting that the materials and treatments are of such a standard as he has a right to expect for such important work as that under discussion.

While discussing this question of "factor of safety" it is

suggested that the several parts with which we have to deal in aero work are really sufficiently small to permit conveniently of numerous quantitative destruction tests, and if more of these were made the engineer would be better able, in a practical manner, to obtain definite data upon which further progress in design might reasonably be expected. After all, a designer endeavors to do that which is almost humanly impossible, viz., to take into consideration all the factors which enter into his particular product, whereas destruction tests do that automatically if properly designed.

Parts in Detail

In cases of failure it not infrequently happens that the metallurgist is called upon to state the cause of trouble. Now the first thing he must do is to form a mental picture of the stresses in operation when the part was doing its work. This is rather an exacting demand, and it would be extremely useful if engineers would endeavor to work out for themselves, and, incidentally, for the benefit of the metallurgist, definite quantitative maximum stress combinations to which parts of varying design may in service be subjected. It is now proposed to consider qualitatively one or two of the items, and it is hoped that the discussion later will amend and extend any observations which are made.

The crankshaft is a most important part and requires very careful study. No doubt engineers look with pride upon efficient designs, and yet even such fail at times. Now, if failure take place, over-stressing has been a fact, whatever may be the ingenious argument of the designer, and hence —and this is a typical case—not only must one examine the design and material of the crankshaft, but also, as Mr. Dickinson has pointed out, the influence of the various other items with which it is in operation. It is desirable that an engine should develop a steady torque, and that it should run as free from vibration as possible. This, we understand, is usually accomplished by a suitable arrangement of the cylinders and cranks, such that (1) the torque developed by one cylinder shall level up the irregularities in point of times in the development of torque by the others; (2) the inertia forces consequent on the high rate of revolution shall be so disposed as to give dynamic balance. These are two distinct requirements, and the satisfaction of one does not necessarily mean the satisfaction of the other. Modern design, however, appears to approach very nearly to ideal theoretical conditions in these respects. Attention must also be given to the fluctuation of torque, and to the effects of inertia forces in the individual parts of the engine. In a multiple-throw crankshaft the variation of torque in the portion just before the last crank may be from the maximum to zero, or to a negative value. If the shaft is of uniform strength, failure is to be expected at such a point rather than at the point where the stress is more uniform. Bending stresses due to overhanging propeller, etc., would, of course, modify this, and bending at intermediate points due to pressure on crank pin must also be considered. It is stated that trouble frequently arises from insufficient stiffness. A certain amount of flexibility of the shaft under torque should be an advantage rather than otherwise, but it is essential that the crankcase and bearings should be rigidly fixed so as to prevent undue bending action coming on the crankshaft. Accurate fitting is essential to provide this, and at the same time permit free rotation of the shaft in the bearings.

Special care must be taken with the design of the connecting rod. The maximum stress it has to stand is practically that due to the direct pressure from the explosion. When this takes place the crank is nearly on dead center, and the force is received as compression. Before the engine has got up speed the force in the connecting-rod is practically all compression, fluctuating from zero to maximum. At full speed the inertia forces reduce the compression in the connecting rod at explosion and set up tension at other parts of the working cycle. The full range of variation of stress has to be considered, taking into account also the bending stresses due to centrifugal action and the possible modification of stresses due to backfiring. The H section appears to be superior to the hollow tubular section in preventing buckling. Whichever shape is used, special care must be paid to the design of parts where the intermediate length is joined on to the ends which form the bearings. The transition must be very gradual. Any abrupt change will cause concentration of stresses on local areas.

Best Material for Pistons

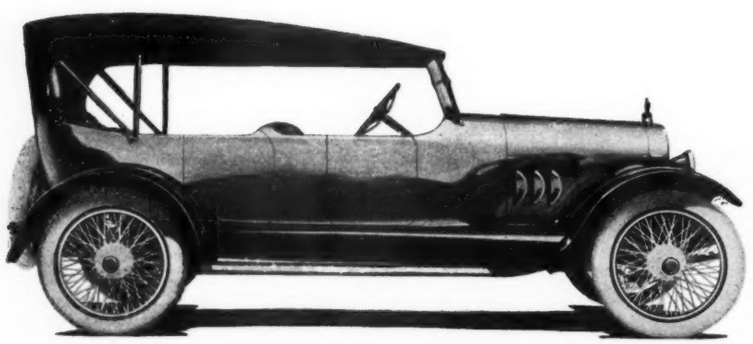
There seems to be an astonishing divergence of opinion as regards the material best suitable for pistons, cast iron, steel, *aluminum alloys* all being in use at the present time. Cast iron appears to be superior in wearing qualities and is found less liable to seize, though this may in part be due to the greater rigidity obtained by employing greater thicknesses of metal, although at high temperatures cast iron is apt to distort and give out. One of the most important points is that the material of which the piston is made shall not deteriorate under the temperatures developed. The author has on at least one occasion had definite indication that the piston head had spent a considerable time in service above the carbon change point, *i.e.*, about 730 deg. C. Generally speaking, the fluctuations of temperature during the cycle of operations takes place too rapidly for such changes materially to affect the temperature of piston or cylinder walls, except just at the skin of the material. The possibility of attainment of extremely high local temperatures at the skin depends largely on the "thermal conductivity" and "specific heat" of the material, high values of these constants tending to reduce the fluctuation in temperature.

When we come to consider cylinders, here again rigidity of form is an important consideration, as distortion due to temperature may put unexpected strain upon the parts. Incidentally, different materials are unequally affected in their mechanical properties with rising temperatures.

We should like to discuss and see discussed the whole of the items with which we are concerned, but it is proposed now to leave this side of the subject and pass to the subject of mechanical testing.

(*To be continued*)

Columbia Adds Four-Passenger Sport Model



THE Columbia Motors Co., Detroit, manufacturer of the Columbia six, has increased its body line by the addition of a sport model having a four-passenger seating capacity. As the name signifies, the car is a rather dashing style of roadster design with the features of length and lowness necessary in this type of body. It has a windshield with a pronounced rake and a low top. The price is $1,350.

While the specifications are the same as for the Columbia cars now on the market as far as the mechanical features of the chassis are concerned, there have been a number of additions in the way of refinement. There are push button locks on all four doors, the instrument board is metal with a Circassian walnut finish and the panel at the rear of the front seat is of the same material. The ignition switch is fitted with a Yale lock and there is a special tonneau and trouble lamp at the rear of the front seat with extension cord of sufficient length to extend to the extreme front or rear of the car.

Another refinement which seems to be in line with a growing practice is the discontinuation of the coat rail and the use of hassocks instead.

Building Up Export Trade

Mastery of Geography Is First Essential, But Finance, History, Transportation Methods and Sales Customs Are Also Important—Peace Will Bring Prosperity to United States

EDITOR'S NOTE—Extracts from an address delivered before the International Exporters' Exposition in Springfield, Mass.

By John B. Maus
Export Manager, Fisk Rubber Co.

GEOGRAPHY is the first essential subject to be mastered before trying to get export trade. There are other vital details to be understood, such as finance, history, transportation methods and sales customs; but the manufacturer who is going into international trade must first of all understand the location and the state of development of the respective world markets.

Confidence is a great factor in overseas trade. Many large credits are based upon confidence. Statements are seldom forthcoming and good judgment is ever essential in this development. The time has passed when one merchant doing business on one side of the street used to lie awake nights hating the merchant on the other side of the street.

Most of the world has as yet been unconquered by automobile and tire trade. England and her colonies contain 11,467,294 square miles, Russia 8,647,657 square miles, Australia and Tasmania alone are greater than the entire United States of America itself; Brazil, only a part of South America, is equal in size to the forty-eight States, with four additional New York States added. This is but a hint of the possibilities of commercial expansion. With the exception of Europe and the United States the automobile and rubber field is practically untapped. Europe after the war, moreover, is sure to be a splendid customer, as the demands of military equipment have drained her supply of motor vehicles, parts and rubber supplies.

JOHN B. MAUS
Export Manager, Fisk Rubber Co.

In many parts of the territory yet to be opened extensively to rubber trade, a general industrializing and increasing of the wealth of the country must first take place. Roads must be built in order that the automobile may reach its maximum use. But aside from the question of good roads in many countries the habits, customs, and smothered ambitions (if they had any) keep the people poor. In such countries if they desired roads they could not finance them, nor would they know how to construct them. In the early days of the United States where the population was of the most hardy and ambitious type, it was necessary to get funds from Europe to promote new enterprises, and to import engineers for our great construction projects such as the Erie Canal. Similarly the civilized and prosperous countries of the world must aid in the development of so-called backward countries; and the nations which render this aid will be the ones to reap the reward.

In some countries there is a great fear of self-propelled vehicles; and in parts of the Far East it is considered beneath the dignity of a gentleman to drive an automobile.

Successful overseas business can be secured and held only by the very closest study. The solicitation of business by advertising or letter writing must first be done in the native tongue of the country to which you are writing, giving not only a complete list of the manufactures of your line, but the terms upon which you will sell, whether on time or cash; against delivery, f. o. b. dock, New York; or against sight draft at destination, etc., etc. Your prospect may be thousands of miles from you where letter communication is extremely slow and difficult, and one letter should contain the history of the whole transaction.

The price lists for overseas trade are generally figured in the native coin of the country in which the tires are sold, in England by the pound sterling; in Russia the ruble; in France the franc; in Spain and Portugal the peseta; in Norway and Sweden the kroner; in Holland the guilder; in Argentina the peso; in Japan the yen; while the Hongkong dollar prevails in China, etc.

Considering, of course, that the language of some of these countries is different from our own we have added to the difficulty of doing business: the difference in money values, metric systems instead of inch standards, difference in postage, weights and measures, laws and customs, cable rates and times. The situation is simplified somewhat by taking as a basic point of origin of the shipment, f. o. b. steamship at New York docks instead of at factory warehouse.

When it is realized that Brazil, for example, comprises twenty-eight independent states, all of which have separate governments, separate ports, tariffs, classifications, rulings, etc., one can readily see the intricacies of the overseas business.

Familiarity with Shipping Routes Needed

Familiarity with shipping routes is very essential, because of the necessity for the expert export manager to sit in his office and follow a shipment from his factory to the docks, from the docks to the steamer, from the steamer oversea to its landing port, where it may be transported by rail, truck or otherwise to its destination, he having in mind constantly the method of handling, the necessity for boxing, the method of packing, all of which is essential for a continuance of business.

For example: A man in Santiago de Chile buying

coffee and requesting it in 25-lb. sacks would be terribly handicapped to receive the coffee in 200-lb. sacks, even though it may be more convenient for the American manufacturer to ship it in 200-lb. sacks. The manufacturer would possibly not realize that these 25-lb. sacks are to be strapped across the backs of llamas which are to carry them across the Andes Mountains, and that 200-lb. sacks, with such methods of transport, would be absolutely useless.

Trademarks Must Be Protected

It is extremely necessary to have trade-marks protected. A local dealer may, in some countries, assume the use of a trade-mark which has not been protected and cause a great deal of trouble to the original owner, unless he has it registered prior to the use of it by the natives.

From a language standpoint the advent of the automobile and its equipment has made the coining of words in foreign tongues necessary by each nation, and it is quite interesting to note the interpretation of the word tire in the Spanish language alone. We speak of this word as goma, llantas, pneumaticos, camaras and borrachas, the latter meaning in a single country "a drunken woman." Therefore our company's postal, reading in English "29 acres devoted exclusively to the manufacture of borrachas," in reality meant to them "29 acres devoted exclusively to the manufacture of drunken women." This shows the necessity of using the correct word in the correct place.

You have heard a great deal at this splendid conference about export, but when you realize that in most of the belligerent countries the manufacture of rubber goods, especially for private consumption, has been deferred, that the shelves are empty, that there are no raw materials, think of the tremendous rush of business immediately upon the declaration of peace which will keep the American industrial plants busy for many years to come. Now, can we hold this business?

Bankers Must Modernize Their Methods

There is no question but that the key to the future is the foreign trade ballot. Just now we are living in an epoch of great prosperity, in a way artificially stimulated by the demand for materials from the nations at war. Whether the advantage thus gained will be upheld depends largely upon the skill and acumen of our bankers to wisely use their money power, and in the farsightedness of our merchants to strive for greater diversification of exports and imports.

It would be well to study the object of the new British Trade Bank, now in the process of formation for the purpose, as its name implies, of furthering the commerce of Great Britain. That institution, when organized and operated under efficient management, with the power to base on its capital a forceful system of credit in the shape of acceptances, will no doubt soon gather the nucleus of a large foreign business.

Co-operative Selling and Financing

It is apparent that it will take something more than the offering of goods to build up and hold the stage which we are now in a position to control. No matter how well our sales representatives may put their story, financial support must be back of the transaction either by the buyer or the seller. We already know the long term credit provided by the German manufacturer backed by his Government which has made it so difficult to compete with German manufacturers, and we should be guarded somewhat to meet, if possible, through the assistance of our banks, these long time credits. Co-operative combinations such as may be deemed expedient to develop our foreign relations in normal times are essential, and should in no sense be considered a contractional restraint of free trading. A recognition of this principal in oversea development is, in my opinion, most necessary to our economic progress. Such privileges should very naturally be accorded to American owned concerns.

If the claims for superiority of American goods are made aggressive realities, and careful, direct, and persistent efforts are exercised by American manufacturers in their introduction and exploitation, it should not be difficult to make permanent our present pre-eminent position in world commerce.

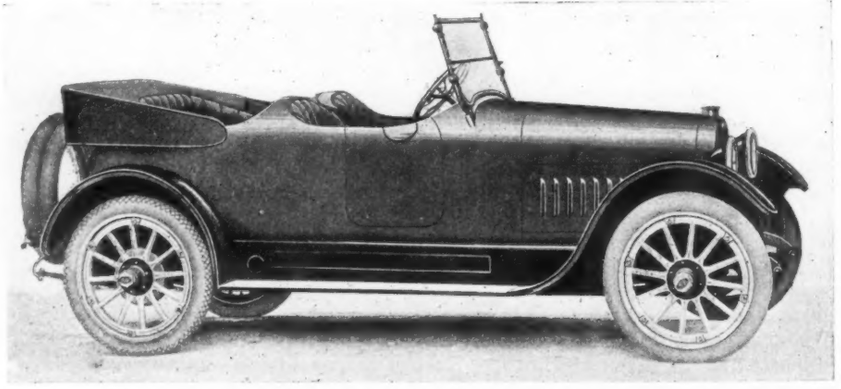
Education for Trade

It appears that to advantageously obtain our place in the international relations, we need not only an efficient banking system and a well-equipped merchant marine, but more especially scientific commercial education. It cannot be too strongly emphasized that these problems must be seriously taken under advisement by the manufacturers. A necessity exists for training our young element in the early stages of its development for business and labors which will devolve upon it later. The business world to-day is vitally interested in this problem, for no organization can succeed in a material degree whose workers are not efficient. If we can encourage early, direct business training, the usefulness of the populace of our country will assure both trading power and wealth.

Now is the time to make arrangements for after-peace business, to provide high standards of quality, intelligent representation, and sufficient encouragement by financial interests to enable the manufacturer to do a world business.

New Four-Passenger Empire

THE Empire Automobile Co., Indianapolis, has brought out a new four-passenger, six-cylinder tour-about, selling at $1,285, f.o.b. factory. This car, which is illustrated herewith, is designated as Model 71 and has the same engine as Model 70A, a Continental 3¼ by 4½. The body has a clean-cut taper from the back of the front seats to the extreme rear. Model 71 has high narrow racing type radiator, sloping hood, staggered windshield and deep front cowl.



Predicts World Traffic by Air After War

Lord Montagu Sees Great Expansion of Airplane Industry—Maps Out Routes and Regulations

LONDON, July 7—World traffic by air after the war and a great expansion of the airplane industry is predicted in an address delivered recently by Lord Montagu. In the speaker's opinion there will be such a development of air travel at the close of the war that it is time already to consider how routes shall be defined and kept and how the best use may be made of the present knowledge of the air currents of the world.

Lord Montagu foreshadowed the day when travelers from England will save 11 days in the journey to India and 23 to Australia, when airplanes will cover a regular average of 1200 miles per day, and when traffic will be regulated in a series of air levels of 2000 ft. each, private planes up to 2000 ft., commercial planes in the next level, "ordinary flying" together with fast commercial machines in the next, then the official planes of each nation, from 6000 to 10,000 ft., including those of the air police who will dive down on offenders in the lower depths, and finally the levels about 10,000 ft., which would be used entirely by machines in international travel.

Postal Service by Air

There are many signs that after the war an effort will be made by all civilized nations to develop a regular postal and commercial communication by means of the air. The British Empire is in a peculiarly favorable position for the development of imperial aviation, according to Montagu, for its widely separated possessions would enable its air traffic round the world, over land and sea, to proceed without asking for concession from other nations. There is a chain of imperial landing places southward and eastward from Gibraltar, about 900 miles from London as the plane flies, toward the Cape, to Egypt, India and the Australasian Dominions. The nearest points between the North American continent and Europe, the west coast of Ireland and the east coast of Newfoundland are also both within the Empire.

For some time to come flying would be more easy over land than over sea, states Lord Montagu, owing to the existence of well organized landing places at fairly close intervals. As regards oversea flying, it is unlikely that straight line routes between place and place would be ordinarily adopted. Allowance will have to be made for air currents and their direction, and the study of these and of meteorology is going to be of supreme importance.

An airplane covers the 1800 miles between St. John's, N. F., and County Kerry at 80 m.p.h. and with a 30-mile wind would do the journey in about 16½ hr.

Lord Montagu said that he would limit the claim to the privacy of the air above property to 2000 ft.; above that private level would be a commercial level, from 2000 to 4000 ft.; the zone would be used only by vehicles with silenced engines and with a maximum speed of 80 m.p.h. The next level would be between 4000 and 6000 ft. for planes also silenced, but with a speed varying from 80 to 120 m.p.h. This level would be for general air traffic for ordinary flying and also for fast commercial traffic. From 6000 to 10,000 ft. the level would be reserved for the official planes of each nation.

These levels would be used by the naval, military, and civil forces, and by police planes, for air police would be needed in the same way that policing of routes by land and sea is now necessary. Specially authorized pilots, and perhaps postal services, would also use the 6000 to 10,000 ft. levels, where the international levels would begin. Levels above 10,000 ft. would be internationalized.

In defining the routes chosen over continents the long and proved experience of the sea could be followed. On the right hand, or starboard side of all routes from the west to east, the direction in which the earth turns, there should be round marks—a white ring, containing a black center, while on the left or port side would be checker marks, square in shape. At sea a system of large buoys might be necessary.

Marking the Routes

At night routes should be defined by a continuous white light on the right, or starboard side, and red and white alternating lights on the left, or port side.

Aircraft would be identifiable by the use of the nationally arranged colors of each country for those planes engaged in official service. Private planes should be white, and commercial planes red. All planes, official or private, would be numbered and lettered after the system arranged for international automobile touring.

The land routes would probably be the first to be organized. Passenger services over long distances would only be conducted by day, but mails would probably proceed continuously. On the assumption that the stage-by-stage system, as against continuous flying, would be adopted for passenger service, the following time table for two routes to India and beyond, from Peshawar and Karachi, respectively, to and from London, was given by Lord Montagu in his address:

1—Southern Route to India

First Day—Croydon (London), depart 7 a. m.; Marseilles (625 miles), arrive 12:30 noon, depart 1:30 p. m.; Naples (485 miles), arrive 6 p. m.—Total, 1110 miles.

Second Day—Naples, depart 7 a. m.; West coast of Crete (640 miles), arrive 12:15 noon, depart 1:15 p. m.; Alexandria (485 miles), arrive 5:45 p. m.—Total, 1125 miles.

Third Day—Alexandria, depart 7 a. m.; Jof (580 miles), arrive 12 noon, depart 1 p. m.; Basra (460 miles), arrive 5 p. m.—Total, 1040 miles

Fourth Day—Basra, depart 7 a. m.; Bandar Abbas (575 miles), arrive 12 noon, depart 1 p. m.; Karachi (680 miles), arrive 6:30 p. m.—Total, 1255 miles.

Total distance, 4530 miles; actual flying time, 39 hr., 15 min.; total time on journey, 83 hr., 30 min.

2—Northern Route from India

First Day—Peshawur, depart 7 a. m.; Bokhara (600 miles), arrive 12 noon, depart 1 p. m.; Gurieff (Caspian Sea) (620 miles), arrive 6:15 p. m.—Total 1220 miles.

Second Day—Gurieff, depart 7 a. m.; Lugansk (600 miles), arrive 12 noon, depart 1 p. m.; Tarnopol (610 miles), arrive 6 p. m.—Total 1210 miles.

Third Day—Tarnopol, depart 7 a. m.; Leipzig (600 miles), arrive 12 noon, depart 1 p. m.; Hendon (London) (600 miles), arrive 6 p. m.—Total 1200 miles.

Total distance, 3630 miles; actual flying time, 30 hr. 15 min.; total time on journey, 59 hr.

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British Motor Industries Technical Committee

BY the joint action of the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders, there has been formed a Technical Committee of the Motor Industries as an authoritative body to deal with technical questions arising in the automobile industry. Formerly both organizations had technical committees and their work overlapped to quite an extent. Invitations to be represented on the committee have been accepted by the National Physical Laboratory, the General Post Office, the Institution of Mechanical Engineers, the Iron and Steel Institute and the Commercial Motor Users' Assn.

The new committee will take over the work so far done by the Standardization, Technical and Research Committee of the S. M. M. T., the Steels Committee of the I. A. E. and the Research Division for automobile steels of the Engineering Standards Committee. A government grant of £1000 and a donation of the same amount by the S. M. M. T. will finance the work.

U. S. the Granary of the World

Our Allies, Says Hoover, Look to Us for Their Foodstuffs—We Must Increase National Surplus to Meet Demand—Cautions Against Waste—Suggests Embargo on Foodstuffs as a Means to Stabilize Prices

By Herbert C. Hoover

Food Administrator

¶ EDITOR'S NOTE.—*Not only must the United States help her allies with men and munitions, but—what is perhaps even more important—she must supply them with the food necessary to maintain their armies and keep their civilian populations well fed. In order to do so, said Herbert C. Hoover, before the Editorial Conference of Business Papers, held in Washington, we must increase our national surplus and eliminate all waste.*

WE have entered upon a war entirely unique in its character in that it is a war against ideas. We have found it necessary to enter into this world struggle to see if we could, by joining in, eliminate a miserable theory of which a people have become possessed.

The German people have adopted the theory of evolution in its crudest form in the struggle for existence: the right of might, the survival of the fittest, without any of that temper which the Anglo-Saxon race is imbued with in the necessity to protect the weak and help the helpless. That has so permeated the German character and German institutions that it has bred in them a belief that by national solidarity and complete devotion to the state they will be able to accomplish the mastership of the world. I do not make that as a hysterical attempt at eloquence, but from an intimate contact of two and a half years with the German Army, probably no such contact as has ever before been enjoyed by any one individual, or probably will ever be enjoyed again.

A War of Attrition

The military problems arising out of that becomes one, to-day, of defeating a people. There might have been some hope that they could have been overcome in one grand pressure, but the falling of Russia by the wayside has practically reduced us to a war of attrition. It is possible that with the infusion of democracy in Russia it may rearise, it may become strengthened and again enter upon the field of action, but at the present moment we can look for no support from that source, and the best we can hope for is, by a long-continued war, a war of attrition, a steady grinding, we may succeed in revolutionizing the ideas of the German people so that we may have accomplished our national objective. That objective does not consist of a destruction of the German state nor an extermination of the German people, but consists entirely of a revolution in the German mind.

In order that we may contribute our share to this and secure our ultimate objective, we have got to bring to bear every possible national resource. We have got to build ships; we have got to supply munitions; we must supply our allies with food; and, ultimately, we will have to supply soldiers at the front to maintain the strength of their ranks. That may mean a supply of only 500,000 men initially, but if this war extends over five years it may mean a continuous supply of 500,000 men annually. To do all those things we have in front of us the mobilization of the whole American people. This is not a war of the type that we have heretofore known, where the average proportion of civilians involved with the army amounted to the ratio of approximately one to one and one-half civilians to soldiers in the field. Europe's experience has shown that there is a total of probably twelve to fourteen civilians to every soldier now in the field.

Food the Great Necessity

There is no greater necessity in all this mobilization than the necessity of providing food, not only for ourselves, but in this case for our allies.

Now, to particularize a little on the food situation. Our allies have hitherto drawn their cereals from Russia, Bohemia and Bulgaria, and up to the last two months from Australia and India and from the Argentine. The first three countries have been cut off since the war began. Australia and India are practically cut off, from the shipping point of view, since the troubles on the Atlantic seaboard. There has been a harvest failure in the Argentine, and therefore an embargo. There has been a reduction of man power and some crop failure among our allies. In consequence of all this they are faced with the necessity of finding, during the next year, probably over a thousand bushels of grain, and finding it largely from North America. Normally, if we make no special effort, we should be able to supply them with about 400,000,000 bushels of grain, and I say that practically all grain in their hands to-day is interchanged. Canada may supply 200,000,000 bushels, and therefore we might, without effort, with the normal course of commerce, be able to supply about 60 per cent of their necessities.

It is impossible to restrict the cereal consumption in Europe by 40 per cent and maintain the constancy of those people. We can only hope that those people will have the strength and constancy to keep on if we can do better than that. It should be possible, without disturbing the even course of

North American life—because Canada is willing to take identical action with us—to increase our supply to Europe by another 15 or 20 per cent. That will mean privation, but it will probably leave a safe margin.

Therefore we have a problem in front of us of increasing the national surplus by every device; and growing out of that problem, and out of our own economic conditions, is another serious problem, of equal or more than equal importance, and that is the question of price regulation. If we allow our allies or the neutrals to again run free in these markets, we will again see episodes of the character we did in Chicago a few days ago, and we will see worse, possibly—we will see an exhaustion of our cereals of next year before we have reached the following harvest.

Greater Stability in Prices Essential

Therefore we must restrict the exports from this country with one hand, and we must increase those exports by better management of our food supplies and greater economies and, incidentally, we must not allow this pressure to put the prices of the great staples of this country to a point where we will disturb our own social order.

I doubt whether we could continue, even with the present level of prices, without a wage adjustment in this country, and consequent social disorder and loss of national efficiency. If possible we must have a lower level of prices, and we must maintain a greater stability of prices than during the last year. I speak of stability because my own belief is that one of the prime difficulties of the consumer to-day and of the product as well has been the widening out of the margin between the producer and the consumer, the widening out of that margin steadily since the war began, which has been due not altogether to speculation, but due to the instability of the prices, and the inability of the long chain of distributive organizations to protect themselves in the face of fluctuation, without taking more than normal margins. Therefore, at least as a first step, we must try to get stability.

An Economic Balance Wheel Needed

There are a great many panaceas which have been tried and abandoned. Europe has been a perfect laboratory of efforts to control food prices. Many of them which were looked upon and have been looked upon for years as solutions of the economic difficulty have been abandoned after the first month as wholly impossible. One of those panaceas that is so frequently put forward in this country is the maximum price. We have got to find other devices, and another device lies normally in taking our broken or disrupted distributive chain and repairing or introducing into it a balance wheel of some kind that will make substitution for the lack of level factor of a world price. Perhaps I may become more clear on that if I take one single commodity, and that is wheat. The price of wheat can be compared in a number of vessels; one of those vessels stays in Petrograd, another in Warsaw, another in Rome, another in Liverpool, another in Buenos Aires, and another in Sydney, and so on throughout the world. To-day the whole of these prices is disconnected. Therefore a sudden coincident demand, not necessarily speculative, makes a fluctuation in our prices far beyond the normal. If one went into Chicago to-day to buy 10,000,000 bushels of wheat it might disrupt the price by 70 per cent, whereas before the war it would probably have affected it not more than 2 or 3 per cent. The consequence is that our economic machine is broken, and we must introduce somewhere a new balance wheel until the normal economic conditions can be restored.

The government has asked for the power of embargo. The power of embargo does not mean a prohibition of the export of cereals, but means export under conditions, and the conditions under which these cereals must be exported must have a bearing on the price, and it appears to me and to the other gentlemen who have studied that question that with the embargo in our hands we can stabilize the price without necessarily entering upon a total disruption of the distributing trades.

National Conservation of Waste

There is also the case of sugar. In the case of sugar we are importers. We are competing in Cuba and in other sugar markets between ourselves, and with others, and a little bit of co-ordination would probably reduce the price of sugar and enable us to stabilize the price over the entire year, instead of having a steadily growing price that we have had ever since the war began in this country following each single harvest.

If we can stabilize those prices I think you will find the margin between producer and consumer will diminish materially without damage to the normal profits of the distributing trades.

I only want to point those out as methods of food administration, and to show you that food administration is not food dictatorship in the sense defined by the newspapers.

Now there are other engines in food administration. One of them is the question of national conservation of waste. There are certain types of waste that are national. There is the temperance question. I do not intend, from any ethical point of view, to discuss the quantity of grain which could be saved by the stoppage of brewing and distilling, but we may need to face that question as a war measure, in order to protect our allies.

Many Small Leaks

There are innumerable small leaks in our distributing system which can be corrected without hardship. I will mention just one, to indicate to you their character. The return of bread to bakers from their retail dealers amounts to a probable national loss of something like 2 per cent of our flour. That is a leak which has grown up despite the effort and the will of the trades themselves. No one is so anxious to have that corrected as the baker.

There is also the household leakage, and there is, beyond measure, a large field for effort without

any drastic regulations as to rationing the people. My own view is that our people should eat plenty, but they should eat wisely and without waste. That is a problem that can be handled with intelligence. There are four directions in which, if we could secure the co-ordinated effort of the women in this country we could accomplish an enormous amount of saving. The first of those directions is in the nature of substitution. If we could persuade the housewives of the country to substitute local products for those from distant fields, substitute vegetables in the summer for the staples, and to substitute the staples which we do not wish to export for those which we do wish to export, we could probably revolutionize our export provisions.

There is also the question of reduction in actual eating, as our people probably have eaten an average of 40 per cent more than they need to maintain their health. I do not know that we will ever have gained a great deal on that line, but it is still an abstract fact that it leaves a broad field for consideration.

Then there is the question of household waste; the doctrine of the clean plate.

There is the question of instructions in elementary diatetics in the household, in the teaching of our women that the foodstuffs of their men should be made up of certain portions of vegetables and meat and cereals.

There are hundreds and thousands of avenues in which we could improve the average character of housekeeping from a war standpoint.

No Radical Measures Planned

Now there is a good deal of fear over the country as to the character of the food administration. There is unnecessary alarm. A good deal of interest is exhibited for fear that there will be a total disruption of commerce. It is difficult to impress anyone with the fact that in setting up an administration of that kind, in asking for powers to do most anything, that one is not going to use those powers for any other purpose than to accomplish solely our national objective. Our objective is to win this war, and if it is necessary in order to win this war that we should use those powers, I believe the common spirit of the American people will be behind us.

Premier Brings Out Limousine-Sedan

THE Premier Motor Corp., Indianapolis, Ind., has announced a Limousine-Sedan, a new body design. In this car the top is built integral with the body and in such an ingenious way as to permit of the car being almost instantly converted into either a limousine, a sedan, or an open summer touring car.

As the photographs show, the whole scheme of the car is based on a manipulation of the glass panels which, when not in use, drop into cushioned pockets built into the side body panels and so constructed that the glass cannot rattle or break.

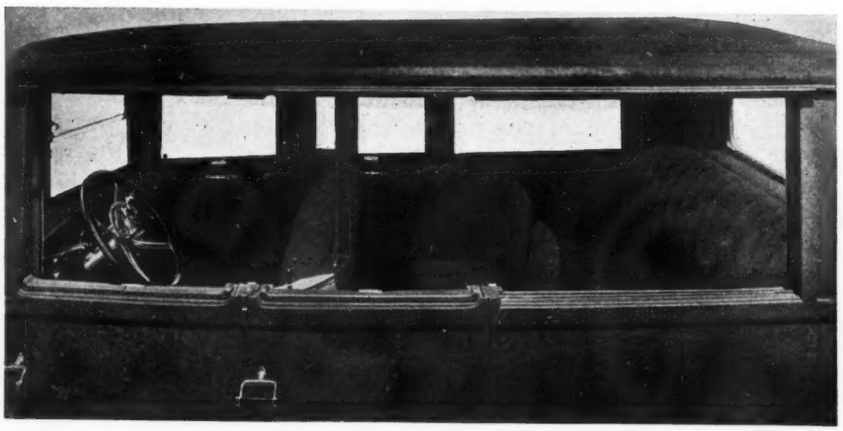
The Premier corporation, it is said, will build these cars in comparatively limited quantities and will carry current with this model the Premier touring car and the Foursome.

The price of the Limousine-Sedan, equipped with the Cutler-Hammer magnetic gearshift, is $3,285, f.o.b., factory.

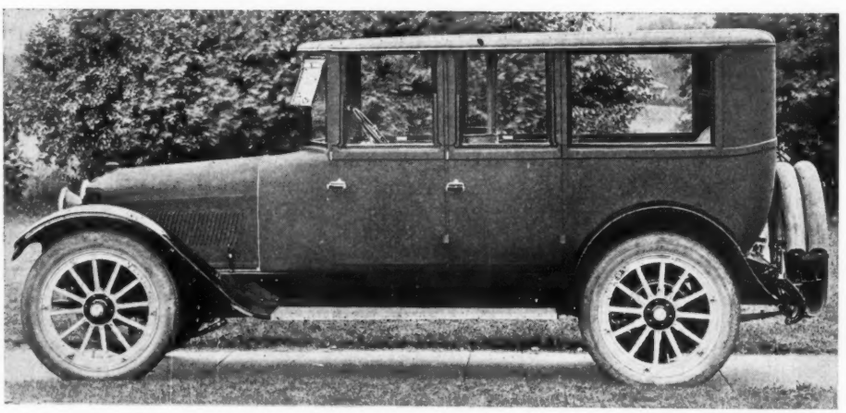
The Premier engine is aluminum. Lynite aluminum pistons are used, as well as Lynite in the cylinder block. The overhead valves are inclosed in an aluminum silencer.

One of the most striking features of the chassis is the 8-in. frame. A V type radiator is used and the wheels are of natural wood.

This new model is now being constructed, and shipments will begin shortly so that it is probable that dealers will have sample cars on exhibition by Aug. 1. The Premier agents expect to push this type heavily for the fall trade with the idea that it will be an especially useful model during the variable autumn weather.



Side view of Premier Limousine-Sedan showing removable top. This can be instantly converted into a limousine, a sedan or an open summer car



Side view of Premier Limousine-Sedan showing likeness to European closed job standards. This model sells for $3,285

New Convertible Body Quick Acting

Can Be Changed from Closed to Open Type or Vice Versa in 1½ Min.—Top Portion Can Be Fitted to Any Car

THE Automatic Converto Body Co., 61 Broadway, New York, has developed a body which can be converted from a completely inclosed to an open type or vice-versa, in 1½ min. without the operator leaving the car and without it being necessary that the car be stopped. The sides and doors of the body are made to form receptacles for windows, which can be raised by the usual pull straps. In addition there is a one-hand top, the frame of which is hinged to the rear of the body and also contains a number of hinged joints. There are pillars at both sides of the rear entrance. These are provided with hinges, so that they can be swung down into the body when the machine is to be used as an open car. As the front pillar would interfere with the seat if swung down directly its hinge is mounted on a pivot so that it can first be turned around through a certain angle before it is swung into the car. In order to keep the pillars from rattling when down they are secured against the side of the body by means of short straps which fasten to them by spring buttons. At the top of the pillars there are dovetail keys which fit into corresponding grooves on the top frame. The pillars are further secured to the top frame by means of spring latches.

On top of the windshield there is a substantial wooden bar into which are set locking devices for the front end of the top. Two slightly tapered bolts on the front end of the top enter corresponding metal sockets set into the bar on top of the windshield. These bolts are provided with slots in the side, and when the top is in position two handles on the windshield bar are turned, whereby locking keys or latches are forced into the slots and insure a rigid connection.

When the Top Is Down

When the top is down the forward end of its frame is secured rigidly to the car body by means of short links swiveling on the frame and which are secured to metal blocks set in the car body, by means of thumb screws. The windows are held rigidly in position by substantial anti-rattling devices. For the window in the door there are two brass flappers which swing down when the window is down and are then securely held in position by a spring clasp. To let the top down, the windows are first lowered, the top is then unfastened from the windshield, a handle secured to the forward cross member of the top frame is grasped and the top pulled back. When about half way back the top balances and remains in position if no further effort is exerted on it, but if it is pushed beyond this position it will automatically drop into the lowered position at the back of the body. To raise the top the operator takes hold of the same handle and pulls forward on it, and if the top is rapidly drawn beyond the balancing position, it drops into position automatically. When down the top can be inclosed in the ordinary top hood in the customary manner.

78,000 Miles Without Rattles

The construction is at present being demonstrated as applied to a Bianchi car which has been driven 78,000 miles. Throughout this period the top has developed practically no looseness or rattle. A somewhat improved model, in which frameless windows are used, is now being constructed. The company plans to issue licenses for the manufacture of these bodies to automobile manufacturers. The top alone can be applied to any type of car, having the advantage that it can be raised and lowered quickly by a single person, and that it is of neat and substantial construction.

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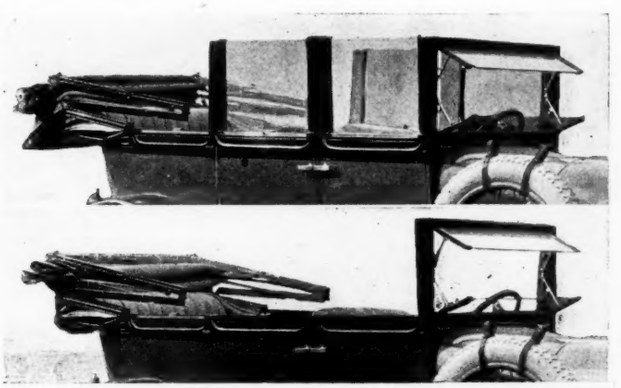
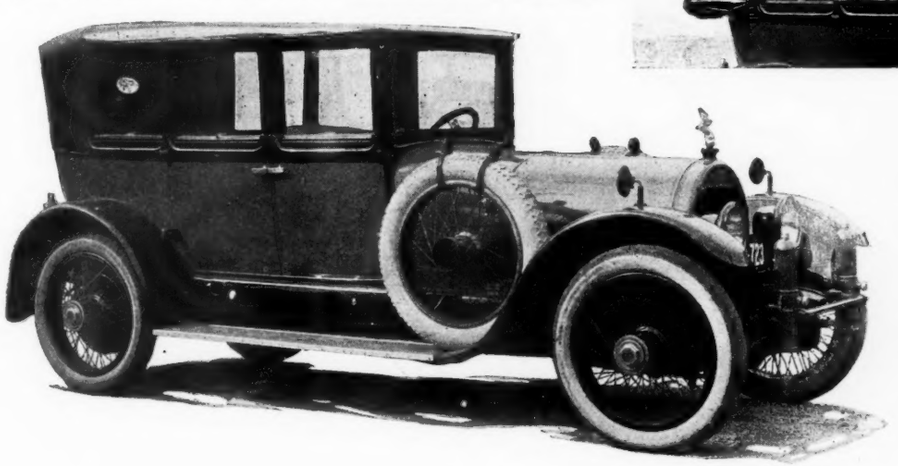
Every Twenty-seventh Person an Automobile Owner

IT has been estimated by Government experts that there are now in this country 1,400,000 owners of passenger automobiles that cost at the time of original purchase $500 or less each; 760,000 owners who paid between $500 and $1,000 for their cars; 1,219,000 in the $1,000 to $2,000 class; and 231,000 having cars of which the list price was between $2,000 and $3,000. There are also in use of course many thousands of cars that cost originally more than $3,000. These figures measure the demand for passenger automobiles during the past several years—one for approximately every twenty-seventh person.

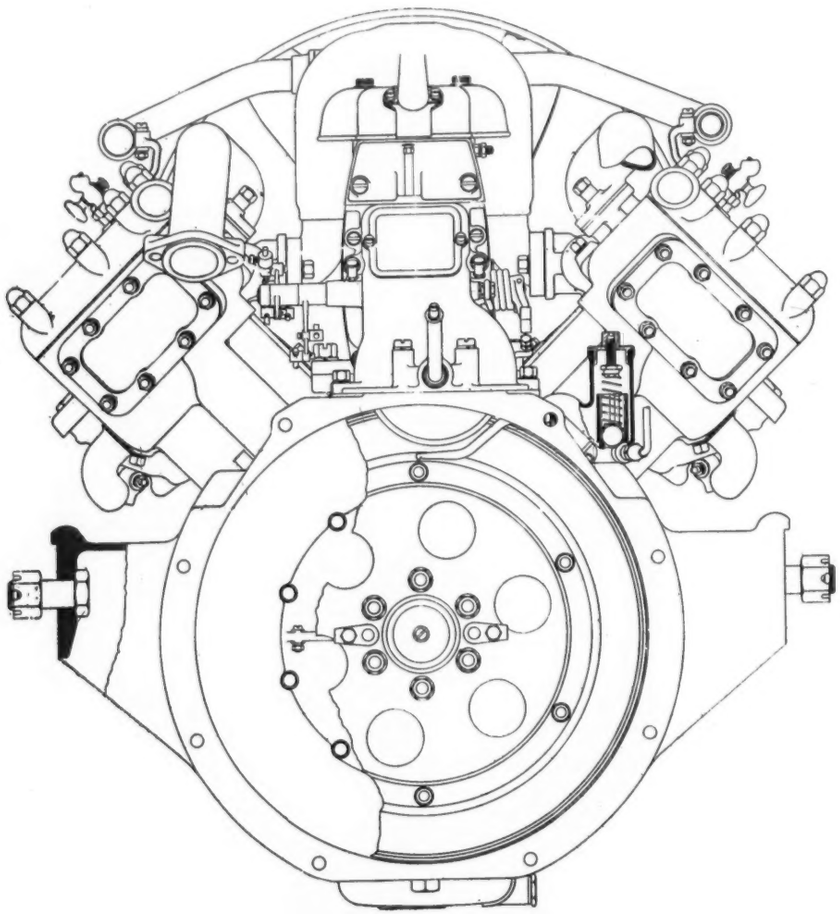




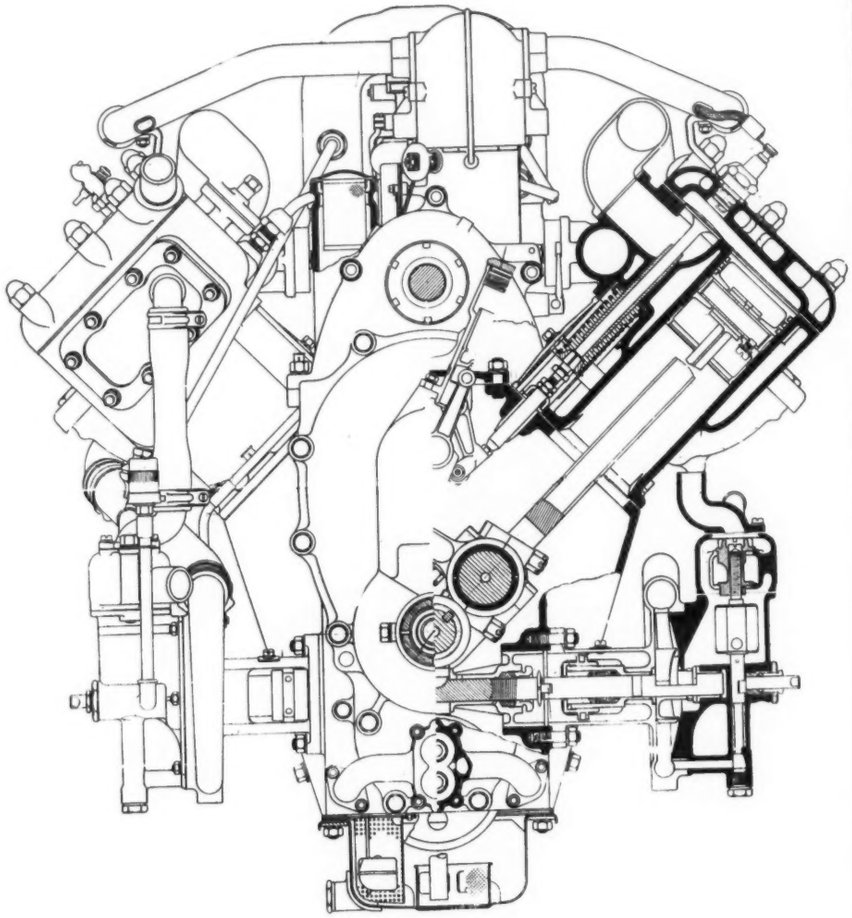
Two views of the new convertible quick-acting body developed by the Automatic Converto Body Co. Upper—With top down and windows up. Lower—With both top and sides down

Left—The body mounted on a Bianchi chassis. It has traveled 78,000 miles without developing squeaks or rattles

1918 CADILLAC EIGHT-CYLINDER ENGINE



Front view of Cadillac eight-cylinder V-type engine, showing the arrangement of blocks and crankcase



Transverse section through Cadillac cylinders showing the operation of the valve system in detail

Better Engineering in 1918 Cadillac

Changes in Chassis and Body Details Make for More Efficient Production—Cylinder Heads Detachable—Fuel, Cooling and Oiling Systems Improved—Bodies of Custom Grade

ENTERING its fourth year of eight-cylinder automobile production, the Cadillac Motor Car Co., Detroit, is starting deliveries on the refined Type 57. The fundamental policies of the company for the past 3 years are continued, notably the making of a single type of chassis with an eight-cylinder V motor, upon which is mounted a complete line of body styles. Throughout the line, however, a great many detail improvements, some of a highly important nature, have been made, and while there are no radical departures from previous Cadillac practice, there are still a number of changes which render the new type considerably different from its predecessors.

Detachable Cylinder Heads

These changes are important from an engineering and a production standpoint as well as from the owner's standpoint. The chassis incorporates improvements in some of its most important details, and the body line has undergone a complete revision, being representative of the highest standard of production body manufacture. In fact, the body line can be compared favorably with the average custom-made product.

All of the important features of the previous eight are retained in the Type 57 chassis, but 3 years' experience in this type of car has resulted in some further improvements.

The cylinder heads are now detachable, being cast entirely separate and secured to the cylinder blocks by twenty nuts on each block. The customary copper-asbestos gasket is used for the purpose of making the joint gas and water-tight. This detachable head makes better manufacturing possible as far as accuracy is concerned, in addition to the advantages of making it easier to remove carbon by scraping and also renders it easier to reach the pistons and valves without removing the entire cylinder block.

The oil filling well is now located on the fanshaft housing at the front of the engine, instead of the center of each cylinder block. Breathers are omitted from the valve covers and are attached to the cylinder blocks on the underside. Annular ball bearings replace the ball bearings of the cup and cone type at the upper end of the distributer shaft. The reason for introducing the annular type of bearing, which is more expensive than the cup and cone type, is that it will hold the contact cam in alignment for a longer period.

The splash pan at the front end of the engine has now been carried back just beyond the rear end of the oil pan. The longer pan prevents cold air from striking the crankcase, and causing a tendency to solidify the lubricating oil in cold weather. There are now also holes through the pan to permit the easy removal of the drain and level plugs.

The cooling system has been revised slightly in order to make repairs better from the service man's standpoint. It is now no longer necessary to remove the radiator to take out the water strainers between the radiator and the water pumps. Plugs for removing these strainers are located at the front of the radiator below the horizontal dust shield.

Gasoline System Improved

A pressure relief valve is located in the air line of the gasoline system on the left frame side member below the front floor. This replaces the T connection at that point in the previous design. The valve is released at a predetermined point, preventing the pressure in the gasoline system rising above what is desired. This provision is necessary owing to the increased use of casing-head gasoline, which is made from natural gas and which has a tendency to develop high pressure when confined.

A special indentation in the gasoline tank renders it possible to conveniently reach the gasoline connections in the tank, by inserting a wrench between the tank and tubular cross member just in front of it.

By a refined design of the gearbox it has been possible to cut weight and give a more compact unit, while at the same time shifting has been facilitated. The latter quality has been secured by the new mounting of the shifter forks which operate the sliding gears. In last year's car the forks are made to slide on the shafts. In the new gearset the forks are attached to the shafts, which in turn slide in bronze bushings at each end of the shaft.

Another improvement is that the multiple disk clutch is attached to the gearset on a splined, instead of a tapered, shaft. This makes it must easier to remove the clutch.

In the steering gear an improvement has been made at the outer end of the sector shaft. This is tapered and serrated with a nut at the end to hold the steering arm, the latter, of course, being also serrated. By this means the serrations give thirty-six driving surfaces as compared with four in the squared-end construction used in the previous model.

Lubrication Accessibility Refined

It is easier to lubricate the Type 57 Cadillac eight than the previous model on account of special provisions which have been made to increase accessibility. Two openings closed by removable covers are located in the tonneau floor of the touring car and phaeton, greatly facilitating the lubrication of the bearing at the forward end of the rear axle pinion shaft; the rear universal joint; and the filling of the two grease cups at the rear end of the torque member. It is also easier to add lubricant to the rear axle, because of an improved rear axle cover plate. There is a connection at the rear end of the starter gear shaft, which fits the end of the oil gun. This was formerly lubricated by an oiler.

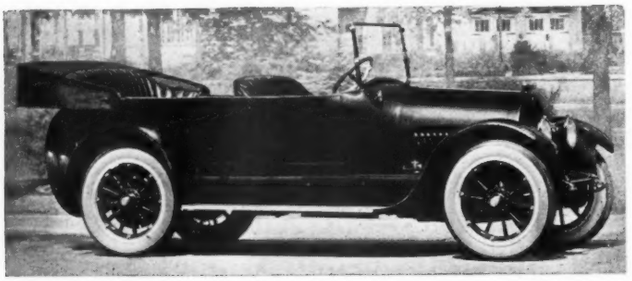
In equipment there is a better horn button and a new tire pump. The horn button operates more easily and will sound the horn when it is touched in any position. The new tire pump is an improved type of Kellog, and is located on the left side of the gearbox.

Body Lines Better

The body line for the 1918 season comprises ten types, three of the previous models have been dropped and two added. Those which have been dropped are the club roadster, seven-passenger convertible, and the coupé. Those which have been added are the town limousine and the town landaulet.

There have been some changes in outline which give the car a slightly different appearance. On the open cars this is particularly noticeable. The radiator has been raised and the hood correspondingly heightened and made 2 in. longer without shortening the body. This has necessitated the use of a new cowl harmonizing with the heightened radiator. The radiator is approximately 1½ in. higher than in the previous type and the side of the body is 1 in. lower from the running board on the touring car. Body top molding is ⅝ in. wide in place of the 1½ in. molding previously used, and molding ½ in. wide is used on the door, hood and fenders. The doors are of square design and the fenders are provided with four wires to stiffen them instead of two. The distance between the steering wheel and the back cushion of the front seat has been increased approximately ¾ in.

There is more leg-room in the driver's compartment, the angle of the toeboard having been increased. The front



1918 Cadillac seven-passenger touring car selling at $2,590

cushion has been lowered 1 in. and the rear seat cushion ¾ in. The seat backs are higher and more comfortable.

The cowl louvres have been decreased in number, there being nine instead of thirteen. They are longer and set at an angle of 6 deg. to be parallel with the windshield. They are now provided with shutters to close the air exits in cold weather. Another refinement also for cold weather driving is a provision for closing the 1 in. space between the hood and hood shelf.

The cars are now equipped with Marshall springs and the upholstering is hand buffed dull long-grained black leather.

Tilting Headlight Reflector

A new feature is the tilting headlight reflector. By means of a small lever on the left side of the steering post the headlight reflector can be tilted throwing all the light down on to the road where it is most needed in passing other vehicles. There is also an automatic top-raising device, which was fitted on the phaeton made last year. Powerful springs are located in the main bow socket. After the top has been manually raised a few inches, these springs take the load and automatically open the top the rest of the way. The top material is black Pantasote, with the side quarters lined, and the side curtains well tagged to facilitate putting them up quickly.

In addition to the above changes in the open cars, the following dimensions have been changed: On the seven-passenger touring car the overall height with the top up is 1¼ in. lower from the seat and with the top down ½ in. higher. The cushion of the front seat is 2 in. farther from the dash and the steering wheel 1¼ in. lower. On the five-passenger phaeton the overall height with the top up is 1½ in. higher from the seat and with the top down 2¾ in. lower. The cowl is 2 in. higher from the side member and the steering wheel 1¾ in. higher. The rear seat is 1 in. wider. On the roadster the front seat is 1 in. lower and 3 in. wider. The steering wheel is 1¾ in. higher, and the windshield 1¾ in. higher, while the baggage compartment is 2 in. deeper, making a depth of 9¼ in. No change has been made in the rumble seat.

Inclosed Body Refined

The refinements in the inclosed Cadillac bodies have been carried out to a very high degree. The line comprises three limousines, a town car and a brougham. The frame work and upholstering have been designed to equal the best in custom-made bodies. The striped velvet upholstery is laid in French pleats over the seat cushions and backs and lower side quarters below the arm rest. The upper-work, ceiling and doors, are dressed in plain and unplaited velvet of the same color as the lighter background of the striped material. This material is furnished by L. C. Chase. It is known as Mohair Velvet, and is really a plush made from the fleece of the Angora goat. A notable feature is the absence of lace or braid, the binding material being the same as the plain upholstering. The molding for the doors and windows has an ebony finish and all the metal plate work is given a dull wire brush finish. A carpet hassock of the same color as the upholstering is used instead of a foot rail. There is a new pull-to handle on the door covered with plain velvet to match the upholstering, and these upholstered cords are also used as robe rails.

Particular pains have been taken to make the body weather-tight and rattle-proof. The windows are crystal plate and the window mountings are arranged to allow for expansion and contraction due to changes in temperature. An example in the skill used in the construction of these bodies is found in the top header rail, which the sash of all the windows enters when in a closed position. Mounted on this rail is a concealed steel channel lined with heavy felt. When the window is raised to its highest point the glass is engaged by both sides by this felt-lined channel, thus shutting out rain. The driver compartments are protected and the locking system has been simplified as far as possible.

The two body styles added, the town car and the town landaulet, are designed to fill points indicated as desired. The town car is similar to the limousine with the roof of the driver's compartment eliminated. The body is approximately 4 in. narrower than the standard limousine, and the partition window is in one section without the narrow end windows used in the limousine. The town landaulet is like the town car, except for the landaulet feature which allows the passenger compartment to be conveniently opened.

With the changes noted above the Cadillac car remains the same in its mechanical specifications as a year ago. It has the eight cylinder V type engine with its 3⅛ by 5⅛-in. cylinder dimensions and piston displacement of 314 cu. in.

Connecting-rods are the forked end type, and the valves are on the inside of the V, operated by a single central camshaft. Gasoline feed is by pressure, the carbureter is a Cadillac V type, and the car is equipped with a Delco ignition, lighting and starting system.

Cooling is by pump with thermostatic connection, and there is also a condenser to conserve the alcohol supply used in winter.

The clutch is a seventeen-steel-plate type, having nine driven disks and eight driving disks. There is one coil spring held under 300 lb. compression within the clutch hub and the drive is through a three-speed gearset and a floating spiral-bevel axle.

The Cadillac prices and wheelbase lengths for the Type 57 are given in the following list:

Type	Wheelbase	Price
Seven-passenger touring car	125 in.	$2,590
Phaeton	125 in.	2,590
Roadster	125 in.	2,590
Victoria	125 in.	3,075
Brougham	125 in.	3,535
Limousine	132 in.	4,085
Landaulet	132 in.	4,235
Imperial	132 in.	4,285
Town limousine	132 in.	4,100
Town landaulet	132 in.	4,250

Speedway Provides Testing Apparatus

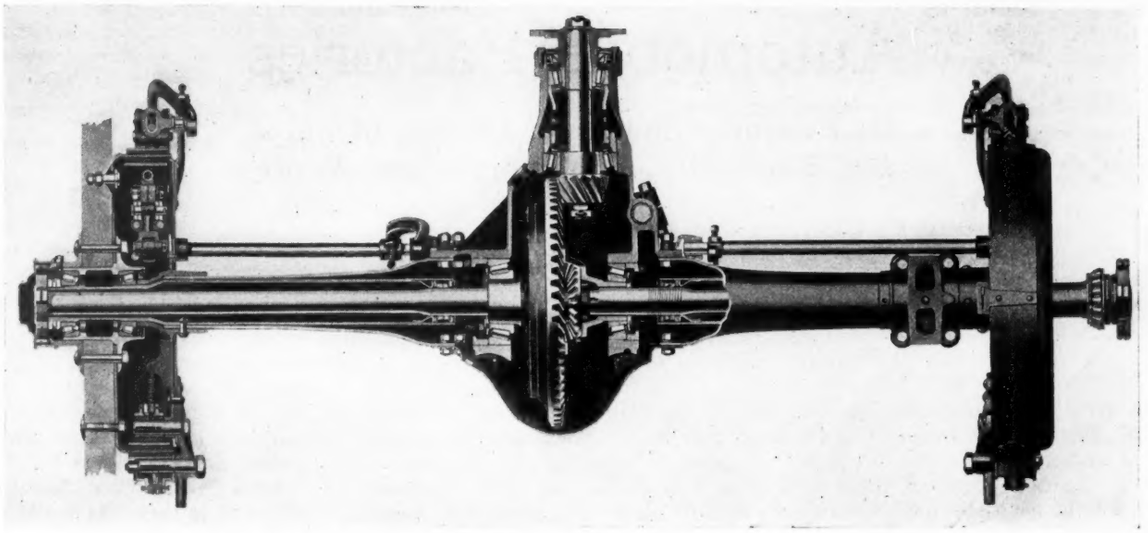
TESTING apparatus conforming to S. A. E. recommendations has been provided by the Indianapolis motor speedway to determine fuel economy and rate of motor acceleration. Anyone who desires the information on the performance of his car may have the automobile tested at a nominal cost and within two days' time.

The most important feature of the S. A. E. tests on fuel economy is the weighing of the gasoline used in the running of a given distance, instead of running on a given quantity of gasoline and measuring the distance. By running a uniform distance it is possible to eliminate speedometer errors and measure the rate of speed during the test precisely. Economy tests are run at the following m.p.h. minimum: 10, 15, 20, 26 to 30, 35 to 40, 47 to 55, 63 to 70, and maximum. The S. A. E. requires that at least 2 lb. of fuel be consumed during a run. A Ford will run from 7.5 to 10 miles on 2 lb. of gasoline where a larger car will run but 5 miles or less. In connection with such a test the humidity of the air, the fractional distillation of the fuel, the motor temperature, and the thermometer temperature of the air are determined. With this data and the gravity of the gasoline known the miles per gallon can be accurately computed.

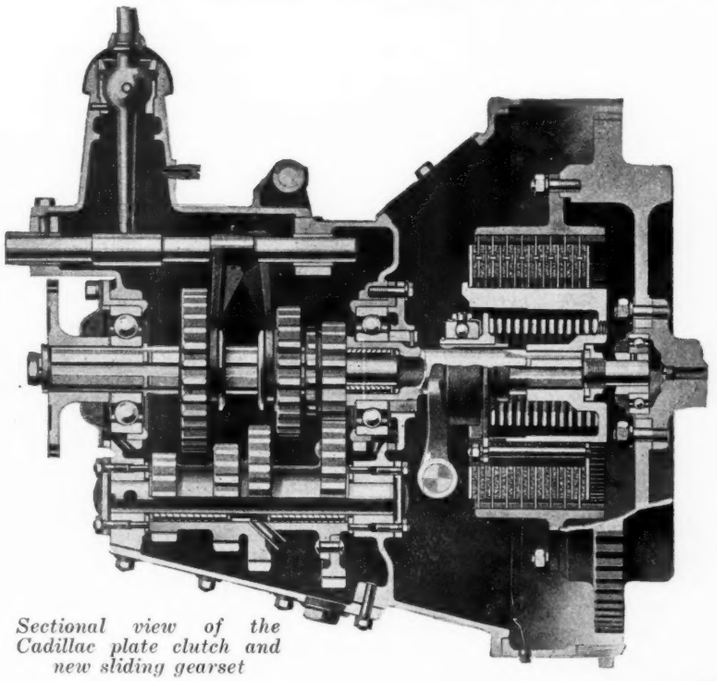
A testing device for determining the rate of acceleration is also provided at the speedway. This is operated by an electric contact attached to one of the front wheels. A record of the revolutions of the front wheel is made on a moving tape and at the same time another pen operating on this main tape gives the time in seconds.

A motor laboratory for airplanes and automobiles is being established by the Allison Experimental Co. adjacent to the speedway. In its new plant will be a 600-hp. dynamometer.

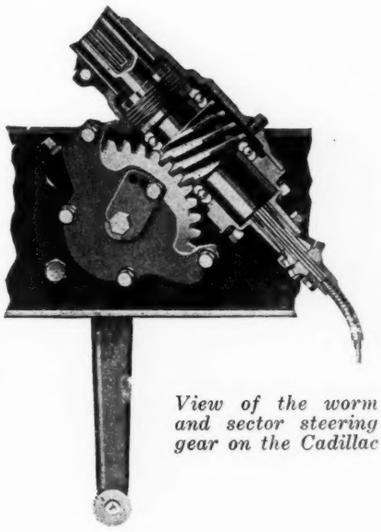
CADILLAC TRANSMISSION AND STEERING



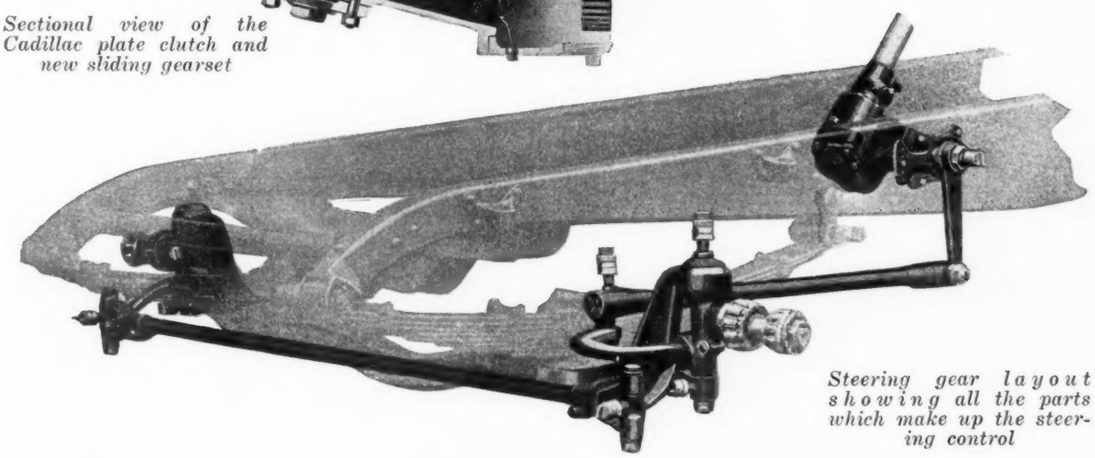
Sectional view of the spiral-bevel floating rear axle used on the Cadillac



Sectional view of the Cadillac plate clutch and new sliding gearset



View of the worm and sector steering gear on the Cadillac



Steering gear layout showing all the parts which make up the steering control

Electric Power Widely Used in Automobile Factories

Its Economy Shown for Driving Machinery, Especially in Machine-Tool Work

By C. E. Clewell
Assistant Professor of Electrical Engineering, University of Pennsylvania

APPLICATIONS of the electric motor for driving machinery in general throughout the automobile industry, but more particularly, perhaps, in machine tool work, involve a number of important factors related more or less closely to the economy of the plant, some of which, if not properly understood, may cause a reduced factory efficiency. It is the purpose of this article to discuss several of these factors, first of all in order to point out their nature, and, secondly, to emphasize ways and means for taking advantage of the economies made possible by intelligent applications of the motor.

In this work both direct current and alternating current motors are very widely used. It is to be noted, however, that where adjustable speeds over wide ranges are desired, the direct-current motor is used, while in those cases where the motor is operated at constant speeds (speed changes being obtained by mechanical means) either direct current or alternating current motors may be employed. In general, the following notes apply equally well to motors of either class except possibly in one or two cases where a distinction has been made in the text.

Power and Wage Savings Contrasted

It is obvious to the reader that the elimination of excessively long line shafting and the substitution of electric motors, either for group or for individual driving, nearly always result in reduced mechanical losses in the power distribution system. The reason for this lies in the higher efficiency of electric distribution in contrast to the use of long and cumbersome line shafts, and the additional gain in centralizing the power units at individual machines or for driving relatively small groups of machines. A long line shaft must usually be running even if only a few of the many machines it drives are in operation, and therefore the frictional losses of the entire line shaft when proportioned over a few machines at such times may make the losses per machine very high. Where an individual machine is equipped with its own motor, however, its driving losses cease with the operation of the machine, since the motor is then shut down and all distribution losses chargeable to this particular machine in the electric circuits also cease (at least essentially so).

Notwithstanding the fact that line shaft losses are on record amounting to as much as 40 per cent of the total power transmitted by the shaft, the saving in power effected by the use of motors, even when such savings amount to 40 per cent, do not influence the factory efficiency to the same degree as other effects which we shall outline below.

No hard and fast rule can be given to show which of the two methods, known as group driving (Fig. 1) and individual motor drive (Fig. 2), for machine tool work should be employed in given cases. As a general proposition, it must be shown that the increased initial investment for motors to be applied to each machine tool is offset by definite returns in the operation of the plant before it is possible to make an intelligent choice of this scheme in preference to that of group driving. This increase in initial cost is of such an order that savings in power alone are ordinarily not sufficient to warrant the added refinements made possible, and hence other more or less indirect advantages of this method of driving are usually emphasized by the motor salesman.

Operating Expenses of a Typical Machine Tool

Fig. 3 is designed to show graphically the distribution of the hourly charges against a typical machine tool (based on data published by A. G. Popcke, Westinghouse Electric & Manufacturing Co., in the *Electric Journal*, December, 1909, page 760). The total hourly charges against a typical machine are here shown to be equal to $2.47, which is to be taken merely as representative, and from the diagram this total charge is seen to be made up of a very small power charge, amounting only to 2 per cent of the total, while the item of wages for the operator coupled with the overhead charges forms the great bulk of the expense. Any savings in power, therefore, either because of increased efficiency in the motor itself or due to reduced losses in the power distribution, will cause changes in an item amounting, as a total, to only 2 per cent of the aggregate hourly charge. If, however, it can be shown that in the operation of the machine by an individual motor the work of the operator is facilitated, any saving thus produced in the wages and in the corresponding overhead may very materially affect the total hourly charge. This should make it evident why a given per cent saving in the power is not to be compared with an equivalent saving in wages for a given operation. Taken as a whole, however, if both a power saving and a saving through increased production for the same wage expense accompany the intelligent application of a motor to an individual machine tool, it is quite possible that they together may not only completely offset the increased investment, but may even show an excess return in favor of the individual motor.

Indirect Economies Illustrated

Several examples will serve to show how these indirect advantages of the motor drive may be realized. It is a matter of common experience that speed gradations with mechanical gear changes or with cone pulleys are usually accompanied by larger or smaller gaps in the available speeds. This feature is even more noticeable where a given cutting speed is to be employed on a lathe, for example, which is used for work of widely different diameters. Thus for a given cutting speed, a shaft with a

large diameter must be turned at a low number of revolutions per minute, while a shaft with a small diameter must be run at a higher number of revolutions per minute. The combination of different diameters and definite gear changes may thus often make it impossible to perform the work at the most economical cutting speed.

To illustrate this point further, let us suppose that the gear changes on a lathe result in spindle speeds as given in the following table:

TABLE OF SPINDLE SPEEDS WITH GEARS

Speed Number	Speed Ratio	Spindle Speeds	
		Back Gear In	Back Gear Out
1	1.00	5.00	25.00
2	1.25	6.25	31.25
3	1.56	7.81	39.05
4	1.95	9.76	48.80
5	2.44	12.20	61.00

To take a cut on a shaft with a 5-in. diameter at 55 ft. per minute as a cutting speed means that the spindle speed must be equal to

$$N = \frac{55 \times 12}{2\pi \times 2.5} = 42 \text{ r.p.m.}$$

The nearest lower spindle speed to this value as given in the foregoing table being 39 r.p.m., the machine tool must be operated at this speed at a loss of about 10 per cent in the possible time during which the operation might have been performed if the correct speed had been available. If a motor were applied to this machine with a controller possessing a sufficient number of steps so as to give the correct speed in this case, a definite increase in the output would be possible because of the shorter time taken to do the work, and this saving would be representative of the kind of economies which may result for individually driven tools.

Advantages in Planer Operation

It is also to be noted from the table of spindle speeds that there is a large gap between the highest speed with the back gear in and the lowest speed with the back gear out, and it is reasonable to suppose that where a lathe is used for widely different diameters of work occasions will arise where the most economical spindle speed will fall within the limits of these two speeds, with a corresponding loss in production.

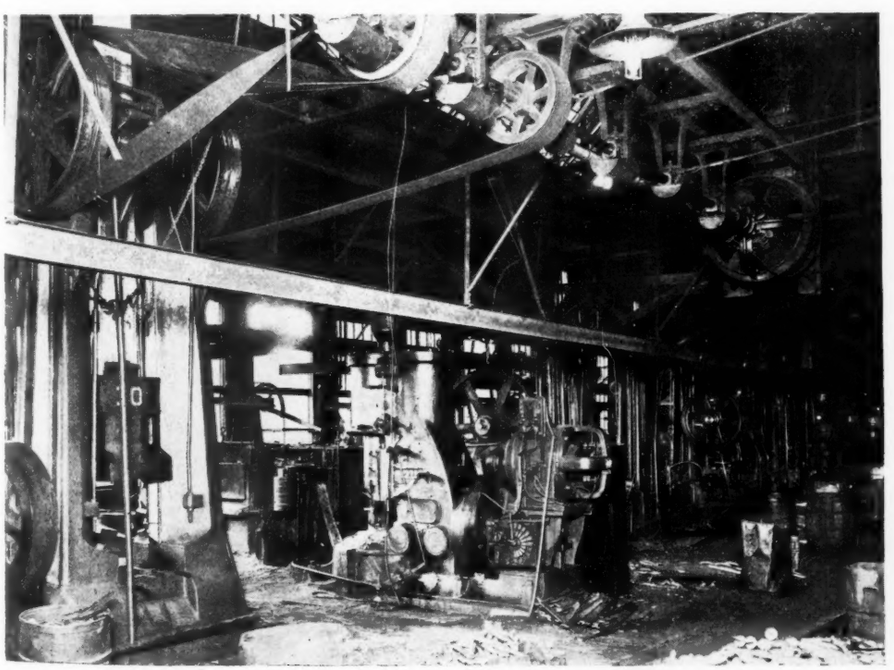
The operation of the planer by its individual motor is another excellent example of the indirect advantages which may result from the use of the motor. Where the reversing motor equipment is employed it is possible to set the speeds for the cutting stroke and for the return stroke independently and at such values as are considered most economical as far as the mechanical considerations of the problem are concerned. The cone pulley with belt drive has limitations in the available speed steps and is not nearly so flexible as the motor, and, moreover, the belt slip at the time of reversal is likely to prolong the time required for making the reversal.

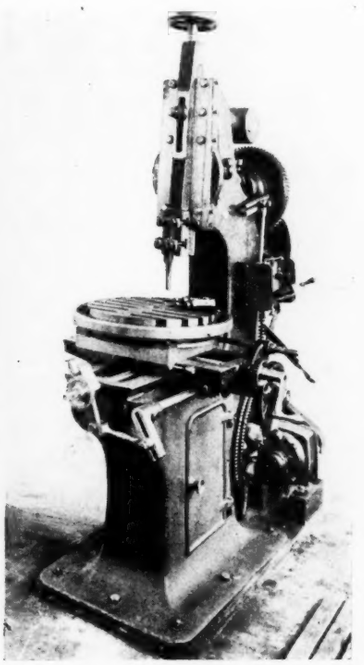
These features may amount to much larger percentages in the losses than is realized. We find, for example, from investigations made by A. G. Popcke that the change from a ratio of 2 to 1 (between return and cutting stroke speeds) to a ratio of 4 to 1 can alone save as much as 1 hour and 20 minutes in a 10-hour day. Figures are also on record where a motor-driven planer was able to reduce the time of each of its working cycles from 19.4 seconds with belt drive down to 13.4 seconds with the motor drive, this being a saving of 6 seconds in 19.4, or about 30 per cent.

Necesity for Careful Selection of the Motor

Savings of this kind can, of course, produce very marked economies in the production rates of any plant, and they are more important than the savings in power, as previously pointed out, because of their relation to a large per cent of the total production expense. Taken together, these indirect advantages and the corresponding energy savings thus may have a very important bearing on the efficiency of any factory.

To realize these advantages, however, it is of the utmost importance to exercise care in the selection of the motor. The factors which enter into this selection may be covered in a very general way by the statement





Left—Fig. 1—An example of group driving. Nine drop hammers driven from an 80-ft. line shaft, which carries 18 flywheel pulleys 30 in. by 8 in., in turn driven by a 40-hp. motor. Compare with Fig. 2. Right—Fig. 2—An example of an individually driven machine tool. Six-inch slotter driven by a 550-volt induction motor. Compare with Fig. 1

that the characteristics of the motor must be such as to meet successfully all the demands imposed by the mechanical characteristics of the driven machine. Quite a number of points must be given consideration, and among them is the determination of the size of the motor, this specific problem being used here to illustrate one angle of motor selection.

Determining Size of Motor

The size of the motor—that is, its horsepower rating—is not determined solely by its maximum load—that is to say, the maximum load which it may be called upon to deliver during its most severe cycle of operations; but is commonly based on what is termed the "square root of the mean square current" or the effective heating current value taken by the motor, which determines the heating and consequently is a basis for the rating. Thus, a lathe may be used to take a number of different cuts on a shaft, and the work on each shaft may include the following data of current input to the motor:

First operation 150 sec., motor current 50 amp.
Second operation 200 sec., motor current 70 amp.
Third operation 180 sec., motor current 0 amp.
Fourth operation, 100 sec., motor current 20 amp.
Fifth operation 120 sec., motor current 0 amp.

After the fifth operation, the cycle is repeated for each shaft. The square root of the mean square current for the foregoing values is found as follows:

$(50)^2 \times 150 =$		375,000
$(70)^2 \times 200 =$		980,000
$(0)^2 \times 180 =$		0
$(20)^2 \times 100 =$		40,000
$(0)^2 \times 120 =$		0
750		1,395,000—1,860 = average I^2

Therefore the square root of the average square of the current is equal to 43.1 amp. At 220 volts this current corresponds to:

$$\frac{220 \times 43.1}{746} = 12.7 \text{ hp. input,}$$

or at 85 per cent efficiency to $12.7 \times 0.85 = 10.8$ hp. The maximum horsepower at 70 amp. input will be 20.5-hp. input, or about 17.5-hp. output; hence a 15-hp. motor will probably be ample to take care of the effective heating current, and the maximum demand of about 17.5 hp., being only a 20 per cent increase above normal rating, can readily be carried by ordinary commercial motors.

Importance of Horsepower Calculation

Fig. 4, designed from data gathered by A. G. Popcke, is intended to bring out the importance of this horsepower calculation. In each case the lightly shaded portions show the horsepower rating which the motor should have, based on a test—that is to say, connecting a test motor to the given machine tool and measuring the currents for the different portions of the cycle of operations and then calculating the heating current as explained above, while the total ordinates of shaded and black portions together show the horsepower ratings of motors which have usually been employed for such machines where this careful determination of the exact horsepower has not been followed up. In other words, in the first case shown in Fig. 4 the motor which has usually been employed in the past for the machine in question has been 100 per cent larger than necessary, and so on. To use the larger motor means that the machine will ordinarily be running at a lower efficiency than normal, and that the motor equipment is more costly than necessary, with an excess interest and depreciation charge against the electrical equipment.

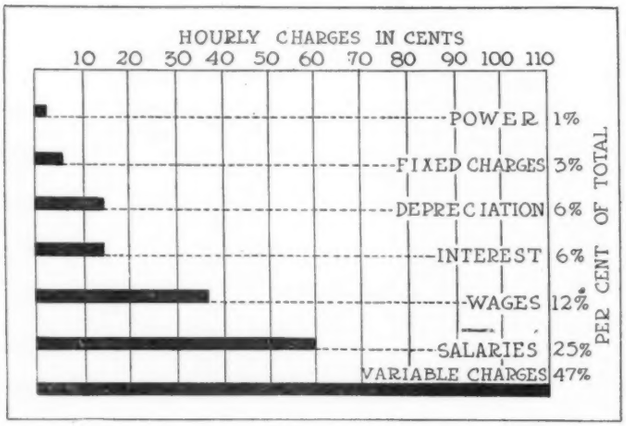


Fig. 3—This chart is designed to show the hourly charges against a typical machine tool. Compare the power charge with the wage and overhead charges

Cooling Rates Factor in Horsepower Determination

One point should receive further attention in the horsepower determination—namely, that the cooling rates at speeds lower than full speed, and also when the motor is at rest, are different than when the motor is running at full speed, because of the fanning action of the revolving parts, which is highest at full speed. Hence, it is customary (based on Westinghouse Electric & Mfg. Co.'s practice in the selection of alternating-current motors for intermittent service) to compute the motor rating on the basis of the duration of a cycle, *which is equivalent to full speed.* In the foregoing calculation for the heating current the divisor was 750 actual seconds, whereas by the scheme here referred to this actual time should be reduced to an equivalent time corresponding to full-speed conditions.

An Example of Heat Dissipation

Thus it is found that, while accelerating and coming to rest, the dissipation of heat occurs at a rate which is only about half as great as at full speed, and that while at rest open motors dissipate their heat about one-third as fast and inclosed motors only about one-half as fast as at full speed. An example will illustrate the modification which must be applied to take care of these differences in the rate of heat dissipation. Suppose the cycle of operations for a hoist has the requirement as given in the following:

150 hp. for 10 sec. (acceleration period)
90 hp. for 20 sec. (constant full speed)
0 hp. for 5 sec. (coming to rest)
0 hp. for 30 sec. (at rest)

The actual interval of this cycle is 65 seconds. Let us work out now the equivalent interval in terms of full speed, thus: The interval at full speed is unchanged—20 seconds; for the period of acceleration and coming to rest we have 15/2, or about 8 seconds; for the rest period (for an open motor) we have 30/3, or 10 seconds. Hence, the total equivalent period is 38 seconds, instead of 65 seconds, and the "square root of the mean square current (or horsepower)" will be found as follows:

$(150)^2 \times 10 =$		225,000
$(90)^2 \times 20 =$		162,000
$(0)^2 \times 5 =$		0
$(0)^2 \times 30 =$		0
65		387,000

We now divide 387,000 by 38 (not by 65), which gives us as the value of the average square of the horsepower 10,184; hence, the square root of the average square of the horsepower will be about 100 hp. For alternating-current work the motor is then selected with an intermittent rating at least 50 per cent above this value, or

150 hp. Note also that the so-called ½-hour rating should be at least two-thirds of the maximum requirement, regardless of the value found by the foregoing computations when alternating current motors are selected for intermittent service. These rules are naturally dependent on the practice of the manufacturers in rating their machinery and when applying the same to actual cases—that is, to a motor of a given type—the data outlined should be checked through correspondence with the manufacturer from whom the equipment is to be secured.

Electric Power Plays Important Part

Briefly stated, it has been the purpose of these notes to point out that electric power in one form or another is now performing an important part in the automobile industry, and to suggest certain factors which have a bearing on the advantages which may be secured through its use. The functions of the motor are so often in auxiliary form that they are sometimes overlooked when studying methods for improving production. However, the intelligent use of the motor is a subject which may well receive careful attention, since its possibilities are far reaching. It is further hoped that these notes will serve to emphasize forcibly that care in the selection and use of a motor is usually accompanied by much more satisfactory results than when a careless policy is followed.

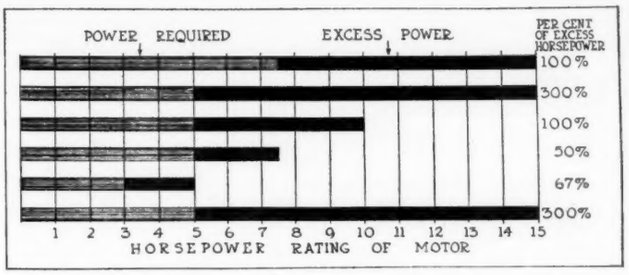


Fig. 4—This chart shows the excess in the horsepower of motors specified for a number of planers in practice. Unshaded areas in the drawing represent rating required; shaded areas, excess

New Sanford 3½-Ton Truck Ready

Built To Develop Maximum Power with Minimum Strain on Transmission and Axle Bearings

HAVING recently made an almost complete change in its personnel, the Sanford Motor Truck Co., Syracuse, N. Y., has placed on the market a 3½-ton truck for which it is claimed that it makes possible the utilization of the maximum power if the engine without imposing undue strains on either the transmission or the rear axle bearings. This truck is equipped with a four-cylinder block engine of 4½-in. bore and 6-in. stroke, having three-point suspension. At 1000 r.p.m. this engine develops 37½ hp. A governor limits the engine speed to 1000 r.p.m., which corresponds to a truck speed of 12 m.p.h. on high gear.

Force Feed Oiling

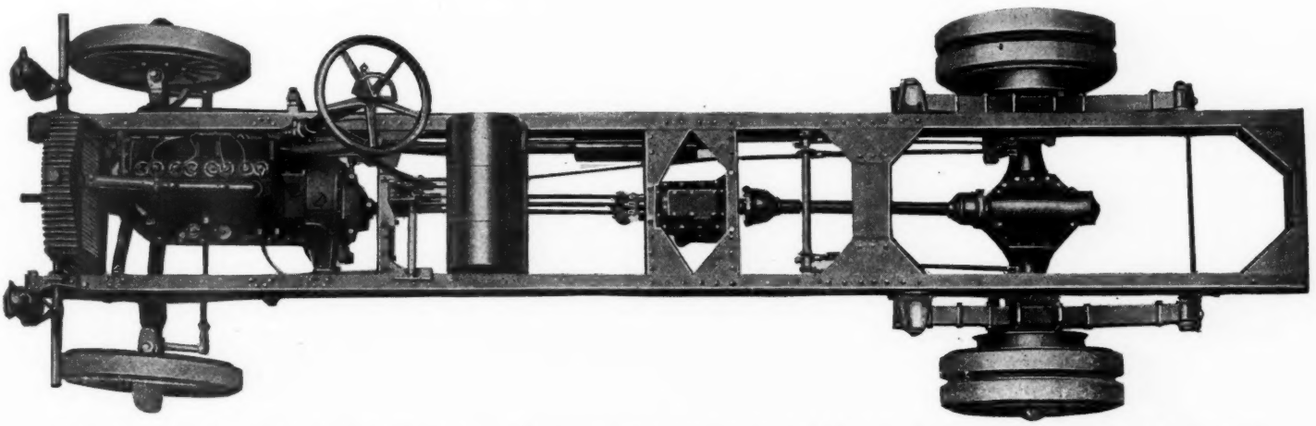
Ignition is by high-tension Bosch magneto. A Stromberg carbureter of 1½ in. size, with side outlet, is fitted. Lubrication is by the force feed system, a geared pump being used.

The clutch is of the dry plate type and is of large diameter. A four-speed forward and reverse transmission is located amidships. It has an unusual low speed reduction, viz. 5:1, which gives an exceedingly high rear wheel torque. The frame is made of channel section members 8 in. deep and with 3¼ in. top and bottom flanges. Alloy steel half elliptic springs are used, the front springs being 3 in. wide by 46 in. long and the rear springs 3½ in. wide by 54 in. long.

Worm Drive Rear Axle

The rear axle is of the worm driven type and has a built-up housing. Worm wheel and differential are mounted on annular ball bearings. The front axle is of I section, measuring 2¼ by 3⅜ in. Steering knuckles and steering levers are made from drop forgings of nickel-chrome steel, heat treated. There are two sets of internal brakes acting on drums on the rear wheels. These are 20 in. in diameter and have an effective width of 2½ in.

Wood artillery wheels are fitted and equipped with solid rubber tires, 36 by 5 in. single in front and 36 by 5 in. dual in the rear. The gasoline tank has a capacity of 21 gal. and is made of seamless drawn steel. The radiator is of the flanged tube type with cast iron top and bottom tanks. This radiator has a frontal area of approximately 625 sq. in. The truck is provided with a driver's cab having a complete set of storm curtains. Its standard equipment consists of side and tail lights, a mechanical horn, the necessary tools and an oil can.



New Sanford 3½-ton truck chassis, showing unusually strong frame construction and giving an idea of the clean-cut simple design. Note midship location of gearbox

The Automobile and Automotive Industries

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Averaging Engineering Practice

SOME criticism has been made recently in the discussions of S. A. E. standards committee division meetings regarding the practice of averaging the practices of different firms in arriving at standards. The argument has been put forth that this average is just as far removed from the best as from the worst practice. It is a specious sort of an argument, but a little consideration shows its weakness. For instance, five concerns may be making automobile engines of the same cylinder dimensions and the length of pistons in all of these engines may vary. We have no means of determining which of the five lengths is the best and which the worst. A long piston makes an engine heavy and slightly more expensive to build, but such a piston has increased life as compared with a short one. So far as is generally known, all five designers had the same object in view—the best possible piston, taking everything into consideration.

In aiming at this end, the result will be somewhat similar as when a number of marksmen aim at a bull's-eye. Few actually hit the center, but if the number of shots fired is considerable it is generally found that about as many hit above as below the mark, as many to the right as to the left, so that the center of gravity of all the hits corresponds very closely to the point aimed at. It is unreasonable to assume that in determining the dimensions of a particular part all but one of a considerable number of designers should err on one side. Errors one way are usually as probable as those the other way, and the average of all the figures is the best that can be derived from existing practice. Of course, care should be exercised in selecting the figures from which the average is drawn to make sure that the designers who determined these figures really aimed at or had reason to aim at the same result.

Dust Separators

THE idea of separating the dust from the air drawn in by vehicle internal combustion engines is not a new one. No doubt the necessity for filtration of the air is greater in the case of the agricultural tractor than in any other type of vehicle, though it is a question whether the conditions surrounding the operation of a tractor in the cultivation of farm lands are much worse than those met with in driving an automobile over dirt roads where the dust after a protracted dry spell is often inches deep. As a matter of fact the use of centrifugal dust separators on automobiles was suggested in France as early as 1900. It was probably the fear that the use of the device would unfavorably affect the volumetric efficiency, which was expressed in an article on the subject at the time, which prevented the introduction of the device.

Experiments made in England at a later date showed that a large percentage of the incrustation found in automobile motors consists of silicates—in other words, road dust—and the presence of this hard material in the cylinders is certainly not conducive to long life of the wearing parts. It would not be surprising if dust separators should be found to materially increase the life of tractor engines, to see them eventually applied to automobile engines as well.

Eliminating Rattles

THERE are very few automobiles or trucks that will run quietly after a month or two of service. The noises that develop are almost all due to lack of tightness at many small points. It is mainly small, light parts which work loose and it is rather remarkable that the industry in general has not yet discovered how to overcome the trouble.

Undoubtedly it is due to some extent to the use of unsuitable materials. Bodies should not be attached by soft iron bolts without lock washers, good steel screws should be used for fender attachment, and so on. But there is more in it than this. There is, for example, a limit of length for a brake rod. A thin rod over a certain length will whip enough under road shock slowly to wear the pins and connections adjacent to it. Brake cross shafts ought often to have larger bearings; pull off springs should be placed with due regard to the parts which are to be kept tight. This sort of chassis engineering is sadly neglected.

News of the Automotive Industries

Government Buys 10,550 Trucks and 5000 Motorcycles

All Orders Given So Far Are for Standard Commercial Products Slightly Modified

WASHINGTON, July 17—The chief of staff of the army has approved contracts submitted to him by the transportation branch quartermasters corps of the army for a total of 10,550 truck chassis as follows:

Packard Motor Car Co., 300 Class B chassis in accordance with schedule L and government specifications as modified by exceptions in Packard exhibit D; delivery to be 100 in August and 200 in September, price $2,803.81 each.

Packard company, 1500 Class B chassis in accordance with schedule N and government specifications as modified by Packard exhibit E; delivery to be 500 per month beginning with October, price $3,197.37 each.

Locomobile company, 400 Class B chassis with electric light equipment, according to government specifications as modified by manufacturers' specifications; delivery to be 125 in October and a similar number each month until contract is completed, price $4,224.57 each.

Four-Wheel-Drive Auto Co., 3750 Class B chassis as per proposal No. 1 with the addition of rear bumpers and ordnance towing hooks at $48 each, total, with bumpers and hooks, $3,248; delivery to be 175 in August and an equal number each month until contract is completed.

Pierce-Arrow Motor Car Corp., 700 Class A in accordance with proposal No. 2, delivery in accordance with proposal $3,500 each. Order to be increased to total of 800 on same terms if agreeable to the Pierce-Arrow corporation.

Nash Motors Co., 3000 Jeffery Quad Class A chassis according to specifications as modified by bidder's proposal; delivery according to proposal, complete by July 1, 1918, price $2,805 each.

Garford Motor Truck Co., 900 Class A chassis in accordance with exceptions by bidder; delivery as per proposal, completed by end of December, 1917, price $2,730 each.

Motorcycles, 3500 Indians, and 1500 Harley-Davidsons $247.50 each, outside price.

All deliveries of truck chassis are f.o.b. factory, shipping instructions to follow later.

It will be seen that these orders go to makers able to deliver quantities around 1000 or over, as has been several times anticipated by THE AUTOMOBILE. The vehicles are in almost every case standard commercial products plus a few details such as special gasoline tanks, extra wide seats, radiator guards and so on. At present there has been no announcement regarding the bodies. Without doubt these will be of all sorts with the majority the regulation stake type most required for general purposes.

The four-wheel drive machines are mainly for the ordnance department for work in connection with guns.

Truck Orders Issued

Packard, 1500 Class B chassis Schedule N.
Packard, 300 Class B chassis Schedule L.
Locomobile, 400 Class B chassis.
Four-Wheel-Drive, 3750 Class B.
Pierce-Arrow 700 Class A.
Jeffery Quad 3000 Class A.
Garford 900 Class A.

Motorcycles

Indian 3500 machines.
Harley-Davidson 1500 machines

Standards for Future Orders

Bearing out as it does the announced plans of the Government, this issuance of large orders to firms capable of supplying large numbers of identical vehicles which will each be able to form complete fleets of their own, will still more stimulate the work of standardizing the assembled military truck now in progress. There has been and probably there still is considerable misunderstanding of the standardization scheme which was never intended to apply to the orders now being and about to be issued.

Much of the criticism of the scheme has been directed at the specifications themselves on the assumption that the chassis called for is too large and massive. For example, one opinion given by a military officer in close touch with the buying end of the service but not close to the engineering end was given as follows:

"Governmental criticism of commercial trucks which were used in the Mexican campaign was brought about by misuse of the trucks such as overloading, overspeeding, incompetent drivers, etc., conditions which it is said will not obtain with the trucks as it is contemplated they will be used in the army now, when so many trained truck drivers will be available. It is held that present standards now being evolved carry no insurance that the vehicles built according to their specifications would prove more satisfactory under conditions similar to those on the Border.

"The present standards, it is held, are admittedly expensive to manufacture and maintain, and are not advantageous for commercial use, a factor which would prevent their disposal by the Government after the war. Truck manufacturers have been led into consideration of changes in their design out of respect for the Government, rather than through the conviction that standard trucks would prove more satisfactory. The continuation of the engineering discussion of the standards which is going on, and which promises to continue, will cloud any conclusion even more than a difference of opinion among manufacturers as to the value of different designs, and with the necessity for the delivery of trucks to meet military needs approaching each day, fear is entertained that the Government will find some day soon that it has specifications but no trucks."

With this view engineers were at first inclined to accord, but their present opinion is very much to the contrary. The military truck built to military specifications and the assembled truck now being worked out by the industry's engineers in accordance with those specifications will be a fine truck in the opinion of all who have had any serious concern with the work. It will, however, carry in commercial service a greater load than the war department plan to place upon it. The Class A truck will be a fine 3-ton chassis, the Class B a fine 5-ton machine.

As to the military need for trucks stronger than the stock products, it is significant that the original anticipation that the Class A trucks would outnumber the Class B by a large majority has lately undergone a rapid change, and it is stated now that the B type may outnumber the A. If it is found that the A is strong enough for a heavier than schedule load, then so much the better for the army.

S. A. E. Tractor Meeting Aug. 8-9

To Be Held in Fremont, Neb., During Tractor Demonstrations—Important Papers

NEW YORK, July 18—A special tractor meeting of the Society of Automotive Engineers will be held in Fremont, Neb., during the week of the tractor demonstrations which begin Monday morning, Aug. 6 and continue until Friday evening, Aug. 10. Wednesday, Aug. 8, has been selected as S. A. E. day at the tractor demonstrations. A special tractor dinner will be held at Masonic Hall that evening and will be followed by a series of papers and discussions on tractor subjects. Arnold P. Yerkes, head of the Farm Management division in the Department of Agriculture, will read a paper on the wider and more efficient use of tractors on the farm. Mr. Yerkes is closer in touch with tractor use than any other government official. He has conducted the two questionnaires which have gone to over 35,000 farmers now using tractors and is familiar with all of the information supplied in the answers to these.

A. C. Bennett, president Wilcox-Bennett Carburetor Co., Minneapolis, Minn., will read a paper Aug. 8 on Kerosene vs. Gasoline as a Tractor Fuel. Several other engineers have been asked to take part in the discussion. There is considerable uncertainty of opinion on this fuel question. Many tractor makers believe that the public is being deceived in the question of kerosene efficiency. Carbureter and engine makers will participate in the discussion.

It is possible that one evening, Thursday, Aug. 9, may be given over to the problem of tractor service.

A meeting of the tractor division of the standards committee will be held during the week.

Already requests for reservations for the dinner are reaching S. A. E. headquarters. The question of furnishing the accommodations for members attending the demonstration is being handled through S. A. E. headquarters. Fremont has not hotel accommodations equal to the occasion, and the Commercial Club has developed an elaborate system for taking care of all members at private houses.

—

Ward Leonard Gets Decision in Generator Control Patent Suit

NEW YORK, July 11—Judge Charles M. Hough sustained the patent infringement action pertaining to a method of controlling the output of an electric generator by H. Ward Leonard, Inc., against the Maxwell Motor Sales Co. in the United States District Court to-day. The injunction granted was suspended to give the defendant an opportunity to appeal. The claim was based on patents Nos. 1,157,011 and 1,122,774 awarded to H. Ward Leonard, now deceased. The invention was made in 1909, and application was filed Jan. 18, 1910. It was alleged that the generator control system used on the Maxwell car, the Simms-Huff, infringed these patents.

The original Leonard patent claims were widely drawn so as to cover many equivalents of the device described in the specifications. His patents covered the method of controlling the generation of electric energy so as to maintain a constant current flow by the use of a vibrator connected directly in the main circuit. When the current generated increases, owing to an increase in the speed of the engine from which the generator is driven, the vibrator will act to reduce the amount of current generated again. This alternating increase and decrease follow one another so rapidly that there is no appreciable variation and the current strength is maintained practically constant. The original Ward Leonard device used a magnetic clutch, but the current models use a resistance in series with a shunt field winding which is cut in and out of circuit by the magnetic vibrator.

The defendant claimed that the present Ward Leonard output was not the controller, that is the magnetic clutch, of the patents in question. The court, however, held that the patents referred to the magnetic clutch as but one embodiment of the patentee's thought.

RICHARD H. COLLINS

President and general manager Cadillac Motor Car Co.

—

Vincent Leaves Packard During War

DETROIT, July 17—J. G. Vincent, vice-president of engineering, Packard Motor Car Co., has left the Packard company for the period of the war, and is giving all his attention to aviation work in Washington. Mr. Vincent has been working with the Aviation Signal Corps.

Collins Is Cadillac President

Succeeds Lelands—Also General Manager—Assisted W. C. Durant

DETROIT, July 16—Richard H. Collins has become president and general manager of the Cadillac Motor Car Co., succeeding the Lelands, father and son. The new head of the Cadillac company was originally with the John Deere Implement & Vehicle Co., Moline, Ill. He was with this company 20 years, then became Western manager at Kansas City. From there he went to the Buick Motor Co. as manager of the Kansas City branch and later to Flint, Mich., as the company's general sales manager. Last year he was made assistant to President Durant, of the General Motors Co., holding this position until the recent appointment to president and general managership of the Cadillac Motor Car Co.

—

New Method for Shipping

DETROIT, July 16—At a meeting of the Detroit Traffic Committee of the National Automobile Chamber of Commerce held here Thursday a plan was adopted for loading cars so that the entire load will be traveling in the same general direction. It is estimated that this will cut down the switching operations of the railroads from 30 to 50 per cent on cars so loaded, thus saving time to the shipper and consignee as well as conserving the supply of freight cars.

Automobile companies load from two to 200 freight cars at a time, and under the plan adopted a report will be received by the traffic manager from the loading dock showing the car number and initial giving the order in which the railroad has placed the unloaded cars. The traffic manager will then assign the loads to each so that cars in each group will be going in the same direction.

The factories represented at the meeting included such concerns as Cadillac, Dodge, General Motors, Hudson, Hupp, Packard, Paige and Studebaker.

—

Standard Parts Acquires Gas Welding Patent Rights

CLEVELAND, July 13—After a careful investigation of the Lloyd patents covering gas welding of tubing, the Standard Parts Co. has acquired rights under these patents. These rights are also enjoyed by the Elyria Iron & Steel Co. and are said by patent attorneys to be dominating in the field of gas welding of tubing.

—

Motor Boat Show Jan. 19-26

NEW YORK, July 16—The motor boat show will open in the Grand Central Palace Jan. 19 and will last to Jan. 26. This will be the fourteenth annual show of the National Assn. of Engine and Boat Manufacturers.

House Passes Airplane Bill

Appropriates $640,000,000 for Building Aerial Fleet and Other Army Needs

WASHINGTON, July 17—The great event of the past week in the aeronautic field was the unanimous passage of the airplane appropriation bill by the House without important amendments and in the record time of less than 5 hr. This bill carries an appropriation of $640,000,000 for the building of a great aerial fleet, the construction of training grounds and the general aeronautic needs of the Army. It was suggested by the Military Affairs Committee that the House refrain from asking for details of plans for the expenditure of the sum appropriated, on the ground that this might be of advantage to the enemy. However, Chairman Fitzgerald insisted upon 30 min. for discussing the administrative features and the appropriation law as involved. The general debate on the bill was limited to 1½ hr.

Secrecy Urged

A feature of the discussion on the bill was the demand made for secrecy regarding details. The Military Affairs Committee offered to disclose any details of the plans given them by Secretary Baker and General Squier to individual members of the House in secret sessions. A demand that the House receive this information in executive session found no support. Very few changes were made in the bill as introduced; one of these limits the availability of the funds voted to the period of the present fiscal year and another limits the broad powers conferred on military officers in regard to the acquisition of buildings and grounds for aviation work to the period of the war.

In a preliminary discussion some criticism was passed on the publication of details of aviation plans by the Bureau of Public Information. Representative Kahn urged that all detail information be kept absolutely secret, as otherwise, when our flying machines arrived at the front, the enemy would be ready for them. Representative Fitzgerald objected to the suggestion that Congress pass over details of the air service plans when the whole thing had been set forth voluminously in statements issued by the Council of National Defense. To this Mr. Kahn retorted that the fact that certain information had been disseminated from time to time through the Council of National Defense did not make it right that such information should be spread broadcast.

Mr. Kahn further stated that as far as the War Department was concerned no further information would be given out regarding the subject in the future.

A suggestion, by a western representative, to cut the appropriation in half, was killed, and the bill was finally passed without a dissenting vote. It will now go to the Senate, and the general impression is that it will be passed speedily, although perhaps not as rapidly as it was passed by the House. For the present the Senate is engaged on the food control bill, and it is doubtful whether it will be able to take up the discussion of the airplane appropriation bill before the end of this week.

A sub-committee of the Military Affairs Committee held extensive hearings on aeronautics for several weeks. It heard nearly all the leading authorities on the subject in the country, including most of the government officials engaged on aviation work. As a result of these hearings the committee is convinced that the war will be won largely in the air and therefore it decided to report the bill immediately. About the only objection from members of the committee was one by Senator Kirby of Arkansas, who thought it unwise to appropriate such a large sum all at once in view of the rapid advances in airplane engineering.

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Leonard Tractor Demonstration July 20

DETROIT, July 18—Demonstration of the Leonard four-wheel drive farm tractor will be held in Jackson, July 20. The tractor will first give an exhibition of plowing and then will do a series of jobs such as will be encountered in ordinary farm work.

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HYDROPLANES FOR NAVY

NEW YORK, July 17—Much satisfaction was expressed in airplane circles here over the speedy passage of the airplane appropriation bill. It was pointed out that the next step would be the introduction of a bill carrying an appropriation for airplanes for the Navy. It is estimated that it will be necessary to train and equip 10,000 naval aviators so that major aerial operations against the German fleet and against the U-boat bases can be conducted at the same time as the aerial operations being conducted against the German military centers, ammunition and aircraft factories and railroads.

A report from Washington, under date of July 14, conveyed the information that Congress will be asked by Secretary of the Navy Daniels to appropriate $1,000,000 for a naval airplane factory. An Italian airplane will arrive at an American port in the next few days, with engine patterns, specifications, etc. It probably will be used by the American Navy as a model of construction.

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Three More A. M. A. Members

NEW YORK, July 16—Three companies were elected members of the Aircraft Manufacturers Assn. at a meeting held last week. These are the Dayton Wright Co., Dayton, Ohio; Wright-Martin Aircraft Corp., New York, and the Aeronautical Engine Division of the General Vehicle Co., Long Island City.

Axle Committee Meets

To Determine Details of Mountings for Class A and B Military Trucks

DETROIT, July 16—The committee on axles, forming part of the organization which is working out the final details of the U. S. A. class A and class B military trucks, is holding an informal 2-day meeting here in the office of C. T. Myers for the purpose of working out the final details of axle mounting and fittings. The results of the meeting will be turned over to the general meeting on Friday at Columbus. Excellent progress is being made and when the committee finishes its work there will be absolute interchangeability of the products of all the responsible manufacturers of axles in the same way as is being done for engines and transmissions. The committee is being favored by excellent co-operation and representatives of practically all the truck companies are on hand.

Those who attended the meeting this morning were: Cornelius T. Myers, consulting truck engineer; Arthur Laycock, chief engineer Sheldon Axle Co.; A. W. Russell, president Russell Motor Axle Co.; R. J. Burrows, vice-president Clark Equipment Co.; D. K. Moore, director of sales, Hess Spring & Axle Co.; A. G. Carlson, engineer Timken-Detroit Axle Co., and F. C. Gilbert, secretary, Timken Detroit Axle Co.

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Lamp Makers Adopt Standards

DETROIT, July 18—Standard specifications for lamp and searchlight equipment for army motor trucks were drawn up by automobile lamp makers in conference here yesterday, and will be presented in the form of a recommendation to the parts makers' conference at Columbus, Ohio, July 20. W. A. Bell, of the C. H. Hall Lamp Co., Kenosha, Wis., is chairman of the committee on lamp standardization.

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Aerial Mail for Italy

NEW YORK, July 17—According to advices received here, Italy will shortly have an aerial mail service between Rome and Turin, which will be the first in the world. An Italian firm has obtained a Government concession to conduct the service. A five-cent stamp will be affixed to all letters sent in this novel way, and the sender must mark upon the envelope "by aeroplane."

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Pratt Leaves Foreign Trade Bureau

WASHINGTON, July 18—Dr. Edward E. Pratt, chief of the Commerce Department's Bureau of Foreign and Domestic Commerce, resigned at the request of Secretary Redfield.

Burnell S. Cutler, a Buffalo manufacturer, first assistant chief of the department, will serve as Dr. Pratt's successor until an appointment is made.

England Needs Tractors by Fall

50,000 Ford Tractors a Year—Dearborn Plant Will Ship Many

DETROIT, July 16—England is not worrying about its grain supply for this season, but there is need for a large supply of tractors to increase the farm area available for the fall and spring planting, according to C. E. Sorenson, manager of the Ford Tractor Farm at Dearborn, Mich., who has just returned with P. L. D. Perry, president of the Ford Automobile Co., of Great Britain, from the other side.

Mr. Sorenson said the Ford company had been asked by the British government to hasten its production on tractors in order that the machines will be ready for use for the seasons mentioned. One of the buildings is already well under way, with the other sections of the Cork factory ready to be started. The productive ability of 50,000 tractors a year will be reached in about 8 months, but before that time there will be a productive ability of 10,000 per annum.

It is also intended to ship a great number of the tractors over from this side and the Ford tractor plant at Dearborn will be on a production basis in less than 60 days. The limiting factor on this side as well as on the other side of the water is the ability to secure raw material. With the government recognition of the importance of a large tractor output, however, it is expected that this will be eliminated and production will not be cut off.

The present scheme, according to Messrs. Perry and Sorenson, is to increase the productive area of the British Isles by about 33 per cent. This will indicate a larger proportionate increase in the amount of grain produced because it is expected that by means of the tractor the plowing and reaping can be carried on under much more advantageous conditions from an agricultural standpoint, with the result of a more intensive output.

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Scripps-Booth Prices Increased

DETROIT, July 18 — Scripps-Booth prices have been increased on the four-cylinder three-passenger model from $935 to $1,250 and on the eight-cylinder four-passenger model from $1,284 to $1,425.

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Lexington Up $60 Aug. 10

CONNELLSVILLE, IND., July 12—Effective Aug. 10, list prices of all Lexington Minute Man models will advance $60.

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Paige Price Increases Revised

DETROIT, July 12—The recent announcements of the price increases by the Paige-Detroit Motor Car Co. have been revised. The new revision shows price increases to be as follows: The Stratford 6-51, $1,595; Fairfield 6-46, $1,450; Linwood 6-39, $1,260; Brookland 6-51, $1,795; Dartmoore 6-39, $1,260; Limousine 6-51, $2,850; Town 6-51, $2,850; Sedan 6-51, $2,400; Sedan 6-39, $1,875.

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Premier $300 More Aug. 1

INDIANAPOLIS, July 16—After Aug. 1 the price of the Premier line of automobiles will advance $300. The present price is $1,985, the advance bringing it to $2,285.

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Hupmobile Prices Advance $100

DETROIT, July 16—Prices on the Hupmobile advanced $100 to-day. The five-passenger touring car, formerly $1,285, is now $1,385; the seven-passenger touring car, formerly $1,440, $1,540; the sedan $1,835, formerly $1,735.

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Chase Advances 3½-Ton Truck Price

SYRACUSE, N. Y., July 19—The Chase Motor Truck Co. has advanced the price of its Model O 3½-ton truck from $3,300 to $3,600, f.o.b. factory.

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New Interests Control Bour-Davis

DETROIT, July 18—The Bour-Davis Motor Car Co. has been taken over by Shadburne Brothers of Chicago, who have moved the stock of that company to Frankfort, Ind., where they will continue to manufacture Bour-Davis cars.

It is planned to discontinue the present model at $1,250 and to produce a new line including a Sedan at $1,800 and a roadster and a touring car at $1,500.

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Chevrolet Adds Two New Models

NEW YORK, July 18—Two new body models have been added by the Chevrolet Motor Co. and a few changes and additional accessories have been added to the Model Four-Ninety. The new models embrace Sedan bodies mounted on the Baby Grand, Royal Mail, and the Four-Ninety chassis. That on the Baby Grand and Royal Mail chassis is styled Model F-A and the other is Model Four-Ninety Sedan. The F-A Sedan sells at $1,475 and the other at $1,060. Both models are shown on page 101.

Changes in the Model Four-Ninety touring car have also been announced. These include improvements in the engine, such as cooling by water pump and a gear type oil pump. A new oil pressure gage has been mounted on the instrument board and the radiator is new, being fitted with a connection for a smaller diameter water hose. New features in this model include the addition of a number of new accessories such as a tire carrier, demountable rims and an extra rim, foot rail, robe rail, tilted windshield, one-man top.

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Motorcycle Engineers Meet Aug. 7

NEW YORK, July 18—The motorcycle engineers will gather together under the auspices of the S. A. E. at a meeting to be held in Atlantic City Aug. 7. This place has been chosen because the Motorcycle and Allied Trades Assn. has a convention there Aug. 6, 7 and 8.

N. Y. State Provides Tractors

Food Commission Buys 41 To Hire Out to Farmers—Other Work

ALBANY, N. Y., July 16—New York State is giving a practical demonstration of how to co-operate in more intensive agriculture and food conservation connected with the war. The state has a commission known as the New York State Food Supply Commission. This commission purchased forty-one farm tractors, thirty-six of which have already been permanently lent to responsible organizations throughout the state. The state purchased these machines with three objects in mind: 1—To increase the crop production. 2—To prove the feasibility of the plan of aiding agriculture in this way. 3—To ascertain the adaptability of the tractors to the various sections of the state.

The plan of the food commission for loaning these tractors to different organizations is as follows: The commission will lend a machine to any organization of responsible farmers provided they will agree to all conditions imposed by the commission. The commission makes a charge of $150 for a two-plow outfit, and $175 for a three-plow outfit, covering its use up to Dec. 1, 1917.

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Everitt Heads Springfield Body

DETROIT, July 18—B. F. Everitt was elected president of the Springfield Body Corp. to-day. He is president of Everitt Brothers, this city. G. W. Woods was elected secretary and treasurer. Mr. Woods is head of the Springfield Realty Co., which concern erected the $1,000,000 body factory just completed here for the Springfield corporation. The results of the recent election of new directors appear on page 126.

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30 Per Cent Earned on Maxwell Common

NEW YORK, July 18—The earnings for the Maxwell Motor Co. for the fiscal year to end this month will be in excess of $5,000,000, which is equivalent to about 30 per cent on the common stock after allowing for first and second preferred dividend requirements.

The July meeting of directors scheduled for yesterday was postponed on account of inability to get a quorum. The meeting will be held next Tuesday, but no dividend action will be taken until Aug. 14.

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New Automotive Inventory Under Way

WASHINGTON, D. C., July 16—A comprehensive inventory is now being made of the automotive industries, including automobile, motor truck, airplane, water craft and allied factories. The work is under the direction of the industrial inventory section of the Council of National Defense, and was inspired by the approaching demand on these factories for their products for war needs.

Airplane Materials Standards

S. A. E. Committee Extends Material Specifications for Parts Outside Engine

NEW YORK, July 17—A meeting to start standardization of materials used in parts of airplanes other than the engine was held here to-day, the following being present:

F. G. Diffin, Chairman, Aircraft Eng. Div., Washington, D. C.; W. H. Bassett, American Brass Co., Waterbury, Conn.; H. L. Greene, Wright-Martin Aircraft Corp., New York; H. J. Horn, John A. Roebling's Sons Co., Trenton, N. J.; Charles M. Manly, Curtiss Aeroplane Co., Buffalo, N. Y.; John A. Mathews, Halcomb Steel Co., Syracuse, N. Y.; M. W. Hanks, Standards Manager, S. A. E., New York.

Comments made by Mr. Diffin revealed the organization of the Advisory Committee for Airplane Materials, Specifications and Inspection. The general committee will come under Mr. Souther of the Aircraft Engineering Division. Mr. George W. Mixter will have general charge, Mr. B. D. Gray will have materials exclusive of metals and Mr. F. G. Diffin will have charge of metals. The scope of operation of these committees will probably include inspection and testing of materials for the allies.

The outline of procedure of this committee will be to formulate suitable metal specifications by the co-operation in each field of the best talent of both American and foreign engineers. The metals are to be produced by the mills in accordance with these specifications, but should there be an occasional deviation due to natural causes of production it is not the intent to reject that particular run of metal but to consign it to salvage with specific markings to indicate its composition. It may then be diverted to uses other than originally intended or a specific heat treatment prescribed which will ultimately bring its physical properties up to standard. In this manner production can be hastened and all materials can be advantageously used. The Government thus certifies to the composition of the material leaving the mills.

A sub-committee on steel, consisting of Dr. J. A. Mathews, chairman, Mr. H. L. Greene and Mr. C. M. Manly, is to make complete investigation of both American and foreign aeronautic steels and formulate a recommendation at the meeting of the sub-committee on steel to be held in Syracuse, July 24.

The next meeting of the Subcommittee on Steel will be held in Syracuse at the Halcomb Steel plant, July 24, at 10 a. m.

The next meeting of the whole committee will be held in New York, S. A. E. headquarters, July 30, at 10 a. m.

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$1,257,461 Earned by Ajax

NEW YORK, July 18—Earnings of the Ajax Rubber company for the first half of 1917 amounted to $1,257,461, equal to nearly $9 a share on the outstanding stock. Sales increased 59 per cent. Net surplus was $1,016,712, after allowing for dividends. Orders for 66,000 casings and 48,000 tubes are on the books. Two dividends totalling $390,000 were paid in the 6 months.

Assets	
Cash on hand and in banks	$625,328
Bills receivable	593,025
Payment on $100,000 Liberty Bonds	18,816
Accounts receivable	3,133,432
Deferred assets	103,550
Inventories	2,311,639
Goodwill account	1,842,701
Investment account	15,100
Plant, equipment, etc	1,740,559
Total	$10,384,150
Liabilities	
Capital stock	$7,100,000
Accounts payable	534,609
Bills payable	1,100,000
Reserves	632,827
Surplus	1,016,712
Total	$10,384,150

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Several New Airplane Standards

NEW YORK, July 16—Many diverse subjects were taken up at a meeting of the aeronautic standards division of the S. A. E. standards committee to-day. Hand holes and drain plugs for seaplane pontoons were discussed and defined in detail subject to navy department approval and arrangements made for devising a standard test for glue used in the wood parts.

The matter of a definition of a "complete engine" for weight stating purposes has provoked much discussion and the division has now decided upon the following definition:

A complete aeronautic engine is considered to include all component parts for proper functioning, with the exception of the following: Gasoline tanks, independent piping and hose, radiator and starter equipment, muffler and muffler pipes, oil cooler and independent sump. Tachometer drive attachment is to be included, but not the tachometer or flexible shaft. Electric ignition equipment is included, but not the connecting wires. The propeller flange, hub and bolts are to be included, but not the propeller. A complete set of tools is to be furnished with each engine.

Another important matter discussed was the provision of tachometer equipment. A sub-committee has been investigating this subject and has recommended that only the clock escapement type be approved.

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CAPITAL CHANGES

TRENTON, N. J., July 14—The Prest-O-Lite Co. will increase its capital from $800,000 to $1,000,000.

MILWAUKEE, WIS., July 16—The capital stock of the Milwaukee Auto Engine & Supply Co., 841 Twenty-ninth Street, Milwaukee, has been increased from $50,000 to $100,000.

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General Tire Co. to Bid

WASHINGTON, July 18—The General Tire and Rubber Co., Akron, has been asked by the Government for quotations on materials. The bids will be sent to Chicago and it is expected they will be opened Saturday.

U. S. to Fix Steel Prices

Makers Agree with Government—War Requirements Widely Distributed

WASHINGTON, July 14—The conference between representatives of the steel industry and of the Government has come to an end, the steel makers having agreed to allow the Government to fix the prices at which they shall supply their products. Secretary of War Baker on Thursday authorized the following statement concerning the settlement:

"At the conference this morning between the committee of the American Iron and Steel Institute and the Secretary of War, the Secretary of the Navy, Chairman Denman of the Shipping Board, and Bernard M. Baruch, of the Advisory Commission of the Council of National Defense, further discussion was had of the prospective demand upon the steel industry of the country for supplies of various steel products for carrying on the war. The steel men repeated their assurance that their entire product would be available for the need, and that they were doing everything possible to stimulate an increased production and speed deliveries.

"The price to be paid for the iron and steel products furnished was left to be determined after the inquiry by the Federal Trade Commission is completed, with the understanding that the price, when fixed, would insure reasonable profits and be made with reference to the expanding needs of this vital and fundamental industry.

"The representatives of the Government assured the committee of the steel institute that it was the intention of the Government to distribute the war requirements over the entire iron and steel producing capacity of the country."

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Dealers Form National Association

CHICAGO, July 12—The National Automobile Dealers Assn. was formed here yesterday by dealers and distributers from the principal cities of the United States.

It is to be made up exclusively of automobile dealers and distributers. There are nearly 30,000 possible members in this country.

Provision is made for the membership of every man who sells cars. Branch managers also are included. Officers are:

President, George W. Browne, Milwaukee; president of the Milwaukee Automobile Dealers, Inc., and Overland distributer in Wisconsin.

First vice-president, John H. MacAlman, Boston; Stearns dealer and president of the Boston Automobile Dealers' Association for 14 years.

Second vice-president, F. W. A. Vesper, St. Louis; Buick distributer.

Treasurer, Thomas J. Hay, Chicago, Chandler distributor.

Secretary, Bart J. Ruddle, Milwaukee; secretary of the Milwaukee Automobile Dealers., Inc., and manager of the Milwaukee shows.

Ross Co. Under New Management

Wildman Vice-President—Six Has Continental Engine—Eight Discontinued

DETROIT, July 17—Two radical changes have taken place recently in the affairs of the Ross Automobile Co. One is a change of management; the other a change of engine. The personnel of the company is now as follows:

Vice-president, N. R. Wildman, a broker and banker of Cleveland; general manager, H. D. W. MacKaye, in the automobile field for 13 years and connected with the Mora, Jenkins, Metzger, King and Keeton companies; sales manager, C. W. Thompson; purchasing agent, F. C. Gumpper, formerly president of the Russell Motor Car Co. and later with the Ford company; production manager, C. E. Banckard, formerly with King, Winton and Packard; engineer, H. C. Kelley, formerly with Krit, Remy and the Long Mfg. Co., and treasurer, G. U. Ulrich, formerly with N. R. Wildman Co., Cleveland.

The Ross company has revised its line and has discontinued the eight-cylinder car which it has had on the market for some time. In its place a six-cylinder chassis will be marketed, fitted with bodies of different types. The chassis of the six is the same as that used for the eight with the exception of the engine. A Continental 3½ by 5¼ engine will be used.

The car itself lists at $1,750 f.o.b. Detroit. The bodies supplied with the chassis are touring car, roadster, sedan, coupe and town car. The leading specifications in addition to the Continental engine are: Multiple disk clutch, floating axle, three-speed gearbox, wheelbase 130 in., tires 35 by 4½ in., semi-elliptic springs and complete body line. The car is provided with Atwater Kent ignition, Ward Leonard electric system and an American rear axle. Wire wheels are supplied at extra cost.

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Springfield Corp. to Increase Capital

NEW YORK, July 13—Stockholders of the Springfield Body Corp. will meet on July 27 to vote on an increase in capital to $3,250,000, to be divided into $750,000 8 per cent cumulative first preferred stock, $1,000,000 8 per cent cumulative second preferred stock and $1,500,000 common stock. This would be an increase of $750,000 in the authorized capital stock.

At the same meeting the shareholders will be asked to authorize the directors to employ a special surplus, provided for in proposed amendments to the articles of incorporation, for the redemption or purchase of the preferred stocks.

All the directors of the company have resigned and a new board has been elected, including the following: H. S. Tenney, C. A. MacDonald, E. W. Wagner, Harry Bill and G. H. Woods.

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DIVIDENDS DECLARED

Packard Motor Car Co., quarterly of 2 per cent on common, payable July 31 to stock of record July 16.

Kelsey Wheel Co., quarterly of $1.75 on preferred, payable Aug. 1 to stock of record July 21.

Security Prices Higher

Improvement Shown During Past Week—Automobile Stocks Up on Reports

NEW YORK, July 17—A general improvement in automobile issues was apparent in Wall Street last week. Though there is still small demand for these stocks, prices during the last few days have risen on reports of decided improvement in automobile trade conditions. Many of the medium-priced producers have reported satisfactory sales. Chandler, General Motors, International Motor, and Willys-Overland showed substantial gains over the previous week's prices.

Several of the tire companies made big gains during the week. Fisk common went up 11 points; Goodrich common rose 2 points; Kelly-Springfield 1 point; U. S. Rubber 3 points; and Lee 4⅝ points. The latter company has shown improvement in its sales. Though net earnings for May were only slightly above $25,000, the important fact is that they seem to promise steady improvement from now on. Sales to the middle of June were in excess of $1,400,000 as against $1,100,000 for the same period a year ago.

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ELECTIONS

TOLEDO, July 13—John N. Willys, president of the Willys-Overland Co., was elected president of the Curtiss Aeroplane Co. at a meeting of corporation directors yesterday. He succeeds

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co	67	69½	—1
*J. I. Case T. M. Co., pfd	80	84	+2
Chalmers Motors Co. com	9	13	..
Chalmers Motors Co. pfd	..	..	..
*Chandler Motor Car Co	86¾	88	+4¼
Curtiss Aero pfd	70	80	..
Chevrolet Motor Co	92	94	..
Fisher Body Corp. com	36½	37	+2½
Fisher Body Corp. pfd	85	90	—2
Fisk Rubber Co. com	74	76	+11
Fisk Rubber Co. 1st pfd	103	106	..
Fisk Rubber Co. 2nd pfd	92	95	..
Firestone Tire & Rubber Co. com	120	124	—2
Firestone Tire & Rubber Co. pfd	103	106	—1
*General Motors Co. com	116¼	117	+3¼
*General Motors Co. pfd	86½	88½	—3½
*B. F. Goodrich Co. com	49½	50	+2
*B. F. Goodrich Co. pfd	104⅛	106½	+ ⅛
Goodyear Tire & Rubber Co. com	198	202	—4
Goodyear Tire & Rubber Co. pfd	105	107	..
Grant Motor Car Corp	3	5	..
Hendee Mfg. Co	25	30	..
Hupp Motor Car Corp. com	2¾	3¼	+ ¼
Hupp Motor Car Corp. pfd	72	80	..
International Motor Co. com	5	10	..
International Motor Co. 1st pfd	30	50	+10
International Motor Co. 2d pfd	10	20	..
*Kelly-Springfield Tire Co. com	47	48	+1
*Kelly-Springfield Tire Co. 1st pfd	88	95	+1
*Lee Rubber & Tire Corp	21⅝	22	+4⅝
*Maxwell Motor Co., Inc., com	44¼	44½	—2
*Maxwell Motor Co., Inc., 1st pfd	60¼	60¾	—3¾
*Maxwell Motor Co., Inc., 2d pfd	28	28¾	—1
Miller Rubber Co. com	175	185	—5
Miller Rubber Co. pfd	102	104	—1
Packard Motor Car Co. com	125	138	—10
Packard Motor Car Co. pfd	95	98	..
Paige-Detroit Motor Car Co	26	28	..
Peerless Truck & Motor Corp	14	17	+1
Portage Rubber Co. com	150	155	—7
Portage Rubber Co. pfd	..	..	..
Regal Motor Car Co. pfd	..	22	..
Reo Motor Car Co	25	27	..
*Saxon Motor Car Corp	18	18½	+ ¾
Springfield Body Corp. com	5	15	..
Springfield Body Corp. pfd	20	45	+5
Standard Motor Construction Co	11	12	..
*Stewart-Warner Speed. Corp	65	67	+2
*Studebaker Corp. com	57⅜	58	—1⅛
*Studebaker Corp. pfd	93	98	..
Swinehart Tire & Rubber Co	59	65	—1
U. S. Aeroplane	6⅜	7	+ ⅛
United Motors Corp	26⅛	26⅜	+1⅛
*U. S. Rubber Co. com	62½	62⅞	+3
*U. S. Rubber Co. pfd	107½	108	+ ½
*White Motor Co	46½	47	— ½
*Willys-Overland Co. com	32	32¼	+ ¼
*Willys-Overland Co. pfd	95	96	+1½
Wright-Martin com	9	9⅛	..
Wright-Martin pfd	50	50	..

*At close July 16, 1917. Listed New York Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co	..	25	..
Bower Roller Bearing Co	..	38½	..
Chevrolet Motor Co	..	..	..
Commerce Motor Car Co	..	11	..
Continental Motor Co. com	6½	6¾	..
Continental Motor Co. pfd. (new)	..	..	..
Edmunds & Jones com	..	..	..
Ford Motor Co. of Canada	220	235	..
Hall Lamp Co	..	23½	..
Hayes Mfg. Co	..	..	..
Michigan Stamping Co. com	..	14¾	..
Motor Products	..	..	..
Packard Motor Car Co. com	..	133	..
Packard Motor Car Co. pfd	..	..	..
Paige-Detroit Motor Car Co	..	28	..
Prudden Wheel Co	..	..	..
Reo Motor Car Co	26⅛	26½	+ ½

INACTIVE STOCKS

Atlas Drop Forge	38	41	..
Kelsey Wheel Co. pfd	82	..	..
Regal Motor Car Co. pfd	..	26½	..

John H. Curtiss, who becomes chairman of the board of directors. William A. Morgan, of Buffalo, is elected vice-president and general manager in charge of all operations.

At a meeting of the board of directors of the Willys-Overland Co. held July 4, Edwin B. Jackson, vice-president, was elected director of the company.

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NEW YORK, July 18—The National Motor Car & Vehicle Co. has elected the following directors: G. M. Dickson, W. G. Wall, S. A. Fletcher, Leonard Snider, O. J. Thoman, Buell Hollister and J. B. Curtis.

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CHICAGO, July 14—D. W. Figgis, formerly of the American Can Co., has been elected president of the Smith Motor Truck Corp., succeeding E. I. Rosenfield. C. R. Hammer, formerly controller of the Haskell & Barker Car Co., has been elected treasurer, to succeed B. E. Veatch.

The Smith corporation reports net earnings for the 6 months ended June 30 last amounting to $934,000; preferred dividend requirements were $56,000, leaving a net profit of $787,000. There were 17,149 trucks delivered during the period, and the unfilled orders on June 30 amounted to approximately 6900 trucks.

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NEW YORK, July 13—Henry F. Vortkamp has been elected president of the Motor Accessories Co., which is arranging to place branches in every State of the Union. One garage in each town will be given the exclusive sale of all its lines.

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DETROIT, July 16—An election of officers and directors of the Michigan Drop Forge Co. was held in connection with a directors' meeting in Pontiac yesterday. At the meeting it was brought out that the earnings of the company have been approximately $5 per share for the year ending Jan. 31 on the common stock.

The officers elected were: B. F. Esgar, of Pontiac, president; Hugh O'Connor, president of the Michigan Wire Cloth Co., vice-president; Paul A. Leidy, of Pontiac, secretary and treasurer, and as directors, John H. French, president of the Michigan Stamping Co.; Robt. T. Herdegan, vice-president and general manager of the Dominion Forge & Stamping Co.; Jos. B. Hamblen, Jr., of the Cady, Ladd & Hill legal firm; Chas. A. Luce, of the Phoenix Insurance Co.; John O'Connor, attorney, Detroit; J. V. Roemmer, general manager of the Detroit Weatherproof Body Co.; O. W. Mott, of the Jackson Rim Co.; William Sparks, of the Sparks-Withington Co., and J. B. Breyman, retired.

The financing of the concern has been handled by Kay & Co., investment brokers, who have purchased a block of the stock for their own customers. The concern handles all sorts of steel forgings and is reported to have a large number of orders on hand and to intend increasing the size of the plant.

179 Franklins Average 40.3 M. P. G.

82.8 Miles on 1 Gal.—Six Did Better Than 60 and Nineteen 40 to 50

SYRACUSE, July 16—In its third 1-gal. mileage demonstration for dealers within 4 years the Franklin Automobile Co. has set up a new figure for gasoline economy. Friday, July 13, Cowles Tolman, of New Haven, went 82.8 m.p.g., which is the best that has ever been done by a stock Franklin, and while the runs were not officially observed by the contest governing societies of the industry the figures are offered by the Franklin company as world's records. Each run was vised by an impartial observer.

In this contest 179 dealers attached a glass bottle, inverted, to the outside of the car near the hood, put in a gallon of gasoline—and ran. All started at the same time on the same day, which assured a variety of weather conditions. The average for the 179 was 40.3. Six did better than 60 and 19 were between 40 and 50.

Detroit was second with 71.6, Akron third with 69.4, and Meriden, Conn., fourth with 69.3.

Cowles Tolman, who made the high mark of 82.8 this year, was high man in the last run, in May, 1915, when he did 55 m.p.g.

Economy has always been a feature in Franklin affairs, since the first cars were made about 15 years ago. It long advertised the record made May 15, 1906, when a car went 87 miles on 2 gal.—43.5 miles per gallon. It advertised still more vociferously the figure set up July 11, 1909, when a car did 46.1 miles on 1 gal.

June 21, 1913, S. G. Averell, a wealthy Franklin fan, in a special and very light roadster, did 83.5 m.p.g., and this was considered a high mark although made under special conditions. The run was officially observed.

Then came the nation-wide economy runs by dealers. In the first, in 1914, an average of 32.8 miles was made by ninety-four dealers. The high mark was 51.2, made by William E. Sanger, Milwaukee.

The 1915 run bettered this somewhat. The high mark was 55, by Cowles Tolman, but the average was a little lower, 32.1; 137 dealers participated.

No run was held in 1916.

FRANKLIN MILEAGE FIGURES

Date	M.P.G.
1906, May 15 (Stock)	43.5
1909, July 11 (Stock)	46.1
1913, June 21 (Special)	83.5
1914, May 1 (Stock)	51.2
1915, May 1 (Stock)	55
1916, July 13 (Stock)	82.8

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Hudson Features Twin City Race Meet

FORT SNELLING SPEEDWAY, MINN., July 14—Ira Vail in a Hudson won the 100-mile race here to-day at a speed of 96.25 m.p.h., his time being 1:02:19.73. Dave Lewis in the Hoskins was second, and Cooper's Stutz, driven by Dutton, was third. Lewis and Dutton fought a close battle, averaging 94.38 and 94.36 m.p.h., respectively. Sixteen cars started.

The 50-mile race was won by Dutton in a Stutz, with Mulford in a Hudson second and Vail and Taylor in Hudsons in the next two positions respectively. The following tables give the summaries for all the events:

50-MILE

Driver and Car	Time	M.P.H.
Dutton, Stutz	30:50.91	97.27
Mulford, Hudson	32:32.26	92.21
Vail, Hudson	32:47.06	91.51
Taylor, Hudson	33:03.81	91.00
Anderson, Duesenberg	33:25.15	89.77

100-MILE

Driver and Car	Time	M.P.H.
Vail, Hudson	1:02:19.73	96.28
Lewis, Hoskins	1:03:34.68	94.38
Dutton, Stutz	1:03:35.06	94.36
Sarles, Frontenac	1:04:46.17	92.64
Mulford, Hudson	1:06:13.07	90.61
Taylor, Hudson	1:07:20.30	89.10
Codwell, Miller	1:08:07.20	88.08
Milton, Duesenberg	1:08:27.85	87.637
Henderson, Duesenberg	1:08:28.00	87.633
Toft, Omar	Flagged 92 miles	
Mason, Ogren	Flagged 76 miles	

HUDSON RACE—10 MILES

Driver	Time	M.P.H.
Mulford	6:41.10	89.75
Taylor	6:41.55	89.66
Vail	6:41.85	89.59

NON-PROFESSIONAL—20 MILES

No. 2—National	16:13.80	73.93
No. 25—Maxwell-Wiederhold. Flagged.		

FORD RACE—10-MILE

Driver and Car	Time	M.P.H.
Wiederhold, Maxwell	10:08.45	59.17
Marshall, Ford Sp	11:59.48	50.04
Forstner, Ford Sp	12:15.13	48.98

To-day's races were promoted by the drivers. About 8000 people attended. It is thought that had better publicity been given the event the attendance would have been better. To-day's race lacked $750 of paying expenses, no money being given the winners. Ten per cent of the gross receipts were given to the Red Cross.

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Elgin Van Speedometer Equipped

CHICAGO, July 18—Elgin cars will be equipped with Van Sicklen speedometers as stock for 1918. The Elgin company is now turning out cars at the rate of forty daily and additional factory space is under construction.

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Packard With Aviation Engine Makes 2 Miles in 58 Sec.

NEW YORK, July 14—What are probably new speed marks for 1, 2, 4 and 6 miles for cars of over 300 cu. in. displacement were to-day made at Sheepshead Bay by a Packard equipped with an aviation 12-cylinder engine, when it made these distances, respectively, in 29 3/5 sec., 58 sec., 1 min. 57 1/5 sec. and 3 min. flat, averaging 121, 124, 122 and 120 m.p.h., respectively. The Brooklands record of 29.01 for the mile made by Hornsted in a Benz June 24, 1914, still stands, but the 2-mile mark of 58.99 made by him the same year has been bettered. The best American track records for those distances previous to to-day were 31.6 sec., made by Oldfield in

a Christie at Tacoma, July 5, 1915, for the mile; 1:10 for 2 miles, also by Oldfield in the same car at Tacoma; 2:20 for 4 miles, made by Resta in a Peugeot at Sheepshead Bay, Oct. 9, 1915.

J. G. Vincent, designer of the engine, intends to again hold tests on the same speedway, and he will then go after the long distance records. The 4 by 6 engine used to-day is slightly changed from that described recently in THE AUTOMOBILE. It has steel cylinders and there are a few minor changes. Its displacement is 905 cu. in. and the chassis used has 106 in. wheelbase. The entire car weighs 2600 lb. empty and develops 108 m.p.h. at 1800 r.p.m. The peak of the power curve is at 2400 r.p.m.

During the tests to-day the car was driven near the top of the track, the position being marked off by Mr. Vincent. It is figured that the car was actually making 10,845 ft. to each lap of the 2 mile course.

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Rowe Absorbs Chain Co.

PLANTSVILLE, CONN., July 14—The Rowe Calk Co., of Plantsville, Conn., has acquired by purchase the Diamond Chain Co., of York, Pa., and the new officers of the Diamond Chain Co. are: President and factory manager, Samued M. Horn, York, Pa.; vice-president, William H. McLaughlin, Hartford, Conn.; secretary, treasurer and general manager, Warren D. Chase, Hartford, Conn.; assistant secretary, S. Ralph Horn; assistant treasurer, E. S. Bestor, Hartford.

The Rowe company manufactures the Prest-O-Grip anti-skid chains for trucks with solid tires. The Diamond chain plant manufactures fire welded chain, and at present has a capacity of over 1,000,000 ft. of chain. It is to be enlarged immediately. The chain company will continue to sell its product in the general market.

Personals

E. H. Belden has been appointed chief engineer in full charge of the engineering departments of the Willys-Overland Co. For the past 6 months Mr. Belden has been affiliated with the research department of the Willys-Overland Co., and previous to that he was one of the executive engineers with the Packard Motor Car Co. Mr. Belden is a member of the Society of Automotive Engineers, and is well known in automobile engineering circles for his work in connection with the products of the Packard organization.

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Ralph Wells has been elected president of the Menominee Motor Truck Co., Menominee, Mich. The other officers are: E. S. Stephenson, vice-president; O. G. Watson, secretary, and G. M. Evans, secretary.

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R. T. Hodgkins, general sales manager of the Studebaker Corp., has joined the navy and has the rank of lieutenant. Mr. Hodgkins was formerly an officer in the navy.

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B. R. McKinney has joined the Corcoran Mfg. Co., Cincinnati, Ohio, maker of automobile fenders, hoods, radiators and tool boxes. McKinney will be in charge of the Eastern territory, effective July 15. He was for a number of years advertising and sales manager of the Livingston Radiator & Mfg. Co. The Corcoran company has added to its line of Ford accessories the No. 12 combination radiator, hood and shield and the Peerless tool kit.

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F. E. Titus has been appointed manager of the foreign sales department of the B. F. Goodrich Co., Akron, with headquarters in New York. He was formerly manager of the Buffalo store and has been in the Goodrich service since 1906.

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Vance McCormick, of Harrisburg, Pa., chairman of the Democratic National Committee, and close friend of the President, is to be chairman of the Exports Council Board, which will have the say as to the licensing of exports. Mr. McCormick, it is understood, has agreed to accept the position at the request of the President.

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Frank R. Bacon, president of the Cutler-Hammer Mfg. Co., Milwaukee, electric controlling devices, has been called into active service as a captain in the Federal commissary department, and left for Philadelphia late last week. Only a short time ago Mr. Bacon was recommended to the national food control council as Wisconsin member by the Governor, but before this position actually has been created by act of Congress Mr. Bacon has been detailed to other duties of a similar but more general nature.

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Philip E. Jackson has been appointed Western sales engineer for the Mayo Radiator Co., New Haven, Conn. He will cover the territory west of Buffalo and Pittsburgh, and will make his headquarters with A. N. Goodfellow, Western sales manager of the Standard Roller Bearing Co. at Detroit.

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C. G. Martin has been appointed manager of the manufacturing department of the J. C. Wilson Co., Detroit. Mr. Martin was formerly connected with the Federal Motor Truck Co.

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Cutler-Hammer Mfg. Co., Milwaukee, has made the gift of a fellowship of $400 for research work in physics to the University of Wisconsin, Madison.

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C. W. Warren, of South Bend, Ind., formerly of the Chevrolet Motor Co., has joined the selling forces of the Monroe Motor Co., Pontiac, Mich., and will cover southern Michigan.

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Stanley H. Rose, of the export department of the Barber Asphalt Co., Philadelphia, has resigned his position to take charge of the New York branch office of the Bureau of Foreign and Domestic Commerce. This office will be of special importance in the department's work of licensing exports under the Espionage Act, as most of the applications for licenses from the New York district will be received at the local office and certain classes of licenses will be issued there without consulting Washington. Mr. Rose has had previous experience as manager of the New York office and has served the bureau in various other capacities in the past. He will enter upon his new duties Monday.

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J. F. Bowman has resigned as director of sales of the Federal Motor Truck Co., Detroit. He has announced no plans for the future.

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Charles E. Stade has been selected general sales manager of the Hydro-Eye Co., maker of the Hydro-Eye valve, which opened a new sales office at 1914-1916 Broadway, New York, July 15. The manufacturing and service departments are being continued at 332 West 70th Street.

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Bee, of Edison Battery, Dies

NEW YORK, July 12—William G. Bee, pioneer in the electric automobile business, died in his home last night in Orange, N. J., after an illness of 2 years. He was vice-president and general sales manager of the Edison Storage Battery Co. He was 48 years old. Mr. Bee operated the first electric automobile seen in the streets of Newport, R. I. On that occasion his passenger was the late Colonel John Jacob Astor.

He was chief gunner of the United States ship Gloucester during the Spanish-American war and survivor of the famous hurricane in Apia harbor March 15 and 16, 1889, in the Samoa Islands.

Mr. Bee was well and favorably known in the automobile field. Early in life he entered the employ of the Pope Mfg. Co. and later became a close personal friend of Colonel George A. Pope. At the end of the Spanish-American war he went with the Edison Storage Battery Co. He was a close and intimate friend of Thomas A. Edison.

Mr. Bee was a charter member of the Aero Club of New York, and held membership in the National Electric Light Assn., the Electric Vehicle Assn., the Automobile Club of America, the American Institute of Electrical Engineers and the S. A. E.

Factory Activities

Goodyear Tire & Rubber Co., Akron, has issued a series of booklets telling the owner how to get better tire service. Former publications gave a long list of "don'ts"; the present ones give a list of "do's." Eleven bulletins are included in the series, and will be distributed through the Goodyear service stations.

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Henry Ford & Son, Dearborn, Mich., have begun the erection of an extensive addition to their present foundry and machine shop, to cover the land south of the present buildings.

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Traylor Engineering & Mfg. Co., Allentown, Pa., is arranging for the immediate construction of marine engines.

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La French Spark Plug Co., Dayton, Ohio, has removed to Columbus and leased quarters at First Avenue near High Street, formerly occupied by the Ideal Heating Co. Harvey C. Garber is interested with other Columbus men in the company, which manufactures a new and improved spark plug.

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Prismolite Co. has completed three new factory buildings at Morgantown, W. Va. One hundred employees have been added to the working force of the company, and from 8000 to 10,000 sets of Prismolite lenses are being turned out daily.

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Duplex Truck Co., Lansing, Mich., is making excavations for the new plant, which is expected to be in operation in 5 months. The building is 400 by 240 ft.

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Kenton Sales Co., Kenton, Ohio, manufacturer of springs and truck bodies, has moved into a larger plant. The springs manufactured are used for converting a Ford car into a truck.

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United Motors Co., Grand Rapids, Mich., is building an annex to its plant. Just north of this another building is being erected for the Samson Trailer Co.

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Racine Auto Tire Co., Racine, Wis., has awarded the general contract for the erection of its proposed new $1,000,000 plant, and work is expected to be put under way about Aug. 1 at the latest. The factory will be 265 by 320 ft. in size, five stories and basement, and occupy a 7½-acre tract. The company manufactures a line of casings trademarked "Horseshoe" and pneumatic tubes and commercial rubber goods.

—

Turbo Carbureter Co., Milwaukee, Wis., organized about 6 months ago with a capital stock of $60,000, is now operating its factory at 150 Clinton Street at full capacity, and has attained a large production of carbureting devices, making possible the use of mixtures of gasoline and kerosene, and in the case of farm tractors pure kerosene. The Turbo company deals directly with automobile manufacturers, and is conducting sales to jobbers through a selling agency. The device is based on the turbine principle and the vaporization of fuel is accomplished three times instead of only once, as in the ordinary carbureting device.

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Federal Rubber Co., Cudahy, Wis., which recently awarded contracts for the erection of another large factory addition, has undertaken plans for an addition to the office building, to be 40 by 145 ft. in size, two stories and basement, conforming with the present offices.

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Clark Equipment Co., Buchanan, Mich., which is making Bescoe steel wheels for trucks used in all the armies of the Allies, is erecting an addition to its factory which will be ready by Sept. 1.

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Youngstown Sheet & Tube Co., manufacturer of iron and steel in Youngstown, Ohio, has opened an office in Detroit at 1032 Dime Bank building.

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Four Wheel Drive Tractor Co., Clintonville, Wis., will add a building 66 by 176 ft. in size, with saw-tooth roof, of fireproof construction. The company will devote its attention exclusively to the manufacture of farm and general haulage tractors employing a transmission system applying power to both front and rear axles.

—

Geuder, Paeschke & Frey Co., Milwaukee, Wis., manufacturer of gasoline tanks and mufflers, as well as various pressed steel parts for automobiles and trucks, is putting up an addition to its tool and die shop. The new building will be 55 by 150 ft. and two stories high. Considerable new machinery has been purchased.

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Porter Mfg. Co., Ann Arbor, manufacturer of commercial vehicle bodies, has established a factory branch in Detroit. Recently this company reorganized and purchased the plant of the Ann Arbor Furniture Co.

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S. & K. Co., Danvers, Ill., manufacturing a combination farm tractor and cultivator, has removed to El Paso, where it will have better shipping facilities. The building formerly occupied by the Marvin Mfg. Co. has been leased for 10 years and machinery will be installed at once.

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Moore Vehicle Co., Chicago, Ill., which has decided to open a branch factory at Danville, Ill., has opened offices in the Chamber of Commerce building. W. A. Welch, fiscal agent, and A. C. Leonard, vice-president of the company, are now in Danville supervising the overhauling of the abandoned car shops, which will be utilized as an assembling and manufacturing plant for the Moore company. The Moore 30 and the Moore 1-ton truck will be manufactured in Danville. The plant will be equipped with machinery as soon as possible, enabling the company to commence operations by Sept. 1.

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Comer Auto Signal Co., Chicago, Ill., has accepted a proposition from the business men of Sullivan, Ill., and will shortly remove its factory from Chicago to Sullivan.

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Kearney & Trecker Co., Milwaukee, manufacturing milling machines, has broken ground for another shop addition to cost about $35,000 with equipment. The plant has been doubled in size during the last 18 months and still is considerably behind on its orders.

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Aeromarine Plane & Motor Co., East Keyport, N. J., has commenced operations at its new plant for the production and assembling of airplanes.

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Napoleon Motor Co., Napoleon, Ohio, is removing its plant to Traverse City, Mich., where it will manufacture passenger cars and trucks.

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Universal Tractor Co., Waukegan, Ill., will build an addition 100 by 750 ft.

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Besaw Rubber Co. and **Ardmore-Akron Rubber Co.** have made plans for plants which will occupy 5 acres of land in Ardmore, Pa.

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Dodge Brothers, Detroit, will build a seven-story brick and concrete addition about 165 by 257 ft.

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Allen Motor Co., Fostoria, Ohio, entertained about eighty of its distributors during the past week. A banquet was held in which selling methods and plans for the coming year were discussed. The balance of the week was devoted to visiting the factory, discussing mechanical service and distributing problems and to pleasure trips on the lake.

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Pan-American Motor Co., Decatur, Ill., is planning the erection of a factory to cost $30,000.

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Henderson Motorcycle Co. will move into its new plant at Bellevue and Mack Avenues, Detroit, within the next 2 months. This plant will double the present output of the company, and will necessitate the hiring of a production manager.

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ST. LOUIS, MO., July 16—The Cupples Co. has started the manufacture of automobile tires. This company has been

manufacturing household articles since 1851, and until a few months ago was known as the Cupples Woodenware Co. The tire department was the outgrowth of a number of years successful manufacture of fruit jar rings. The daily output will be 175 tires and 350 tubes. This will be increased later. The tire is built along established lines, the non-skid tread being letter C, back to back and staggered. The tube is composed of rubber and fabric and rubber and contains a non-puncture liquid. The tire sells for $22 for a 30 by 3 size.

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PLYMOUTH, MICH., July 16—The Federal court has appointed the Security Trust Co. as trustee of the Alter Motor Car Co. The latter company has been under receivership of the circuit court since June 26. Negotiations for the sale of the plant are being made, and the personal property will be sold at public auction July 24.

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PRODUCTION

LANSING, MICH., July 14—Prosperous business conditions are expected by the Olds Motor Works for the next 12 months, and the production of Oldsmobiles is to be tripled during the coming year. That the automobile market will be good is anticipated by Olds distributors, who recently contracted for 32,000 Oldsmobiles.

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CANTON, OHIO, July 14—The American Motor Car Co. has been incorporated with a capital of $100,000 to manufacture automobiles. The incorporators are Clyde A. Volzer, William E. Patterson, Adolph S. Vance, Clotilda Volzer, Jacob M. Glaser and Moritz Glaser.

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DETROIT, July 13—The Saxon Motor Car Corp. delivered 2546 cars to owners in June. Orders for July are showing an increase of 140 per cent over the corresponding period of last year.

Calendar

ASSOCIATIONS

Aug. 6-10—Convention at Atlantic City under auspices of Cycle Parts and Accessories Assn.
Sept. 12-14—Atlantic City, N. J., Motor and Accessory Manufacturers, Mid - Season Meeting.
Sept. 25-28—Pittsburgh National Assn. of Purchasing Agents, Convention.

CONTESTS

July 17-19—Buffalo, N. Y., Intercity Reliability.
July 22—Anaconda, Mont., Track Race.
July 29 — Great Falls, Mont., Track Race.
Aug. 5—Billings, Mont., Track Race.
Aug. 17 — Flemington, N. J., Track Race.
Sept. 3—Uniontown, Pa., Speedway Race.
Sept. 3—Cincinnati, O., Speedway Race, Championship.
Sept. 6—Red Bank, N. J., Track Race.
Sept. 8—Hillclimb, Pike's Peak, for stripped stock chassis.
Sept. 15 — Providence, R. I., Speedway Race, Championship.
Sept. 22—Allentown, Pa., Track Race.
Sept. 28—Trenton, N. J., Track Race.
Sept. 29—New York Speedway Race, Championship.
Oct. 6 — Danbury, Conn., Track Race.
Oct. 6—Uniontown, Pa., Speedway Race.
Oct. 13—Richmond, Va., Track Race.
Oct. 13 — Chicago Speedway Race, Championship.
Oct. 27—New York Speedway Race.

S. A. E.

Aug. 6—Motorcycle Division, Atlantic City.

SHOWS

Aug. 6-10—Fremont, Neb., General Tractor Demonstration.
Sept. 2-9—Spokane, Wash., Interstate Fair.
Sept. 9-15 — Milwaukee Show, State Park Fair, West Allis.
Sept. 9-15 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, West Allis, Milwaukee Automobile Dealers.
Oct. 13-28—Dallas, Tex., Dallas Automobile & Accessory Dealers Assn. State Fair.

1918

Jan. 5-12 — New York Show, Grand Central Palace, National Automobile Chamber of Commerce.
Jan. 19-26—New York, Motor Boat Show, Grand Central Palace, National Assn. of Engine and Boat Manufacturers.

Engineering

American Railway Master Mechanics' Assn.
American Institute of Electrical Engineers.
Master Builders' Assn.
American Society of Heating and Ventilating Engineers.
Association Iron and Steel Electrical Engineers.
Mining and Metallurgical Society of America.
Society of Automotive Engineers.
Illuminating Engineering Society.
National Electric Light Assn.
National Gas Engine Assn.
American Society for Testing Materials.
American Institute of Metals.
American Foundrymen's Assn.
Society Naval Architects and Marine Engineers.

JULY

14—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
16—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

AUGUST

4—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
11—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
20—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
21—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

SEPTEMBER

1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10-14—Assn. Iron & Steel Elec. Engrs. annual convention at Phila.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
15—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
20—Mining & Met. Soc. of Amer. monthly meeting N. Y. section at Engrs. Club.
24—Amer. Inst. Metals at Boston.
24—Amer. Fdry. Assn. annual meeting at Boston.

OCTOBER

6—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
13—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
15—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
17-18-19—Amer. Gas. Inst. at Washington, D. C.
18—Mining & Met. Soc. Amer. monthly meeting New York section Engrs. Club.
20—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.

NOVEMBER

3—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penna. section at Phila.
9—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
10—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
12—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mass. section at Boston.
15—Mining & Met. Soc. Amer. monthly meeting New York section at Engrs. Club.
15-16—Soc. Naval Arch. & Marine Engrs. annual meeting.
17—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
19—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.

DECEMBER

1—Assn. Iron & Steel Elec. Engrs. monthly meeting Phila. section.
8—Assn. Iron & Steel Elec. Engrs. monthly meeting Cleveland section.
10—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ill. section at Chicago.
11—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Mich. section at Detroit.
13—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Penn. section at Phila.
14—Amer. Soc. Heat. & Vent. Engrs. monthly meeting Ohio section at Cleveland.
15—Assn. Iron & Steel Elec. Engrs. monthly meeting Pittsburgh section.
17—Amer. Soc. Heat. & Vent. Engrs. monthly meeting New York section.
20—Mining & Met. Soc. Amer. monthly meeting New York section at Engrs. Club.